www.archelios.fr

Version 11.02

User Manual

Photovoltaic sizing software

A r c h e l i o s

For further information do not hesitate to consult our website: http://www.archelios.fr/

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1. Presentation

Archelios is a photovoltaic sizing software that has been developed and enhanced since 2001 by Alain Ricaud, associate professor at the University of Savoie (France).

It enables to perform extensive photovoltaic studies, from solar resource to sizing and profitability for three types of configurations: grid-connected, secured grid-connected, off-grid.

The horizon mask can be automatically calculated thanks to NASA's topographic datas (missions SRTM http://srtm.csi.cgiar.org).

Archelios computes the annual production of one or several PV fields, the specific production and the performance ratio, depending on the technology selected (crystalline silicon or thin films).

The profitability calculation is based on discounted cash flows forecast. Operating and maintenance costs are taken into account as well as the replacement of inverters. The result give the overall discounted cost of electricity, the net present value, the internal rate of return, the discounted pay-back period and the profitability index.

PRO Archelios PRO version comprises 450 meteo stations, of which 150 for France, more than 8000 modules and 500 inverters and additional functionalities (plugins) for a professional use of the software.

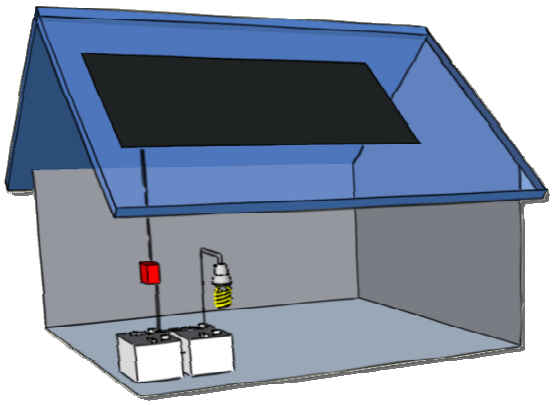
Archelios is distributed through the CeCILL licence (www.cecill.info) which is tailored for free software.

For this project, we received financial backing of the National Agency of Research as well as the University of Savoie.

1.1 What's new in version 11.02 PRO

Autonomous systems simulation:

- Batteries and modules sizing regarding daily electric needs (usage)



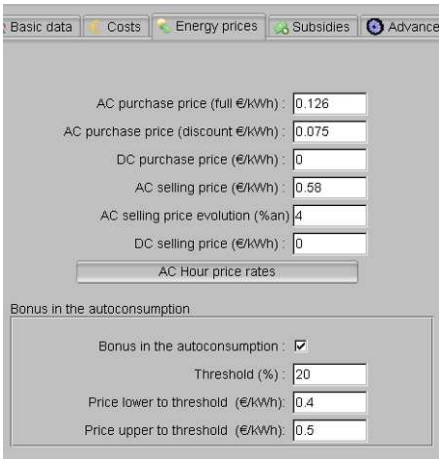
- *Autonomous systems*

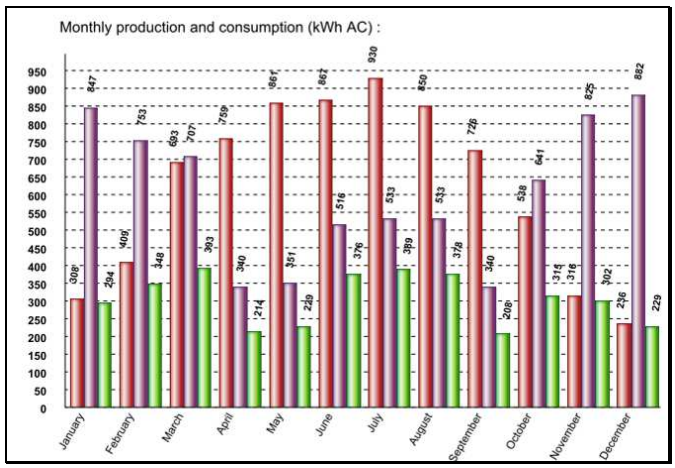
Production estimation:

- Integration of the 1 diode model (I(V) curve simulation) for a better simulation of PV modules behavior under low irradiation
- New functionality for calculation of auto consumption energy, based on needs profiles and hourly production prediction :

Economy:

- Addition of a "auto consumption" tariff (i.e. for German installation) in "Energy Price" tab :

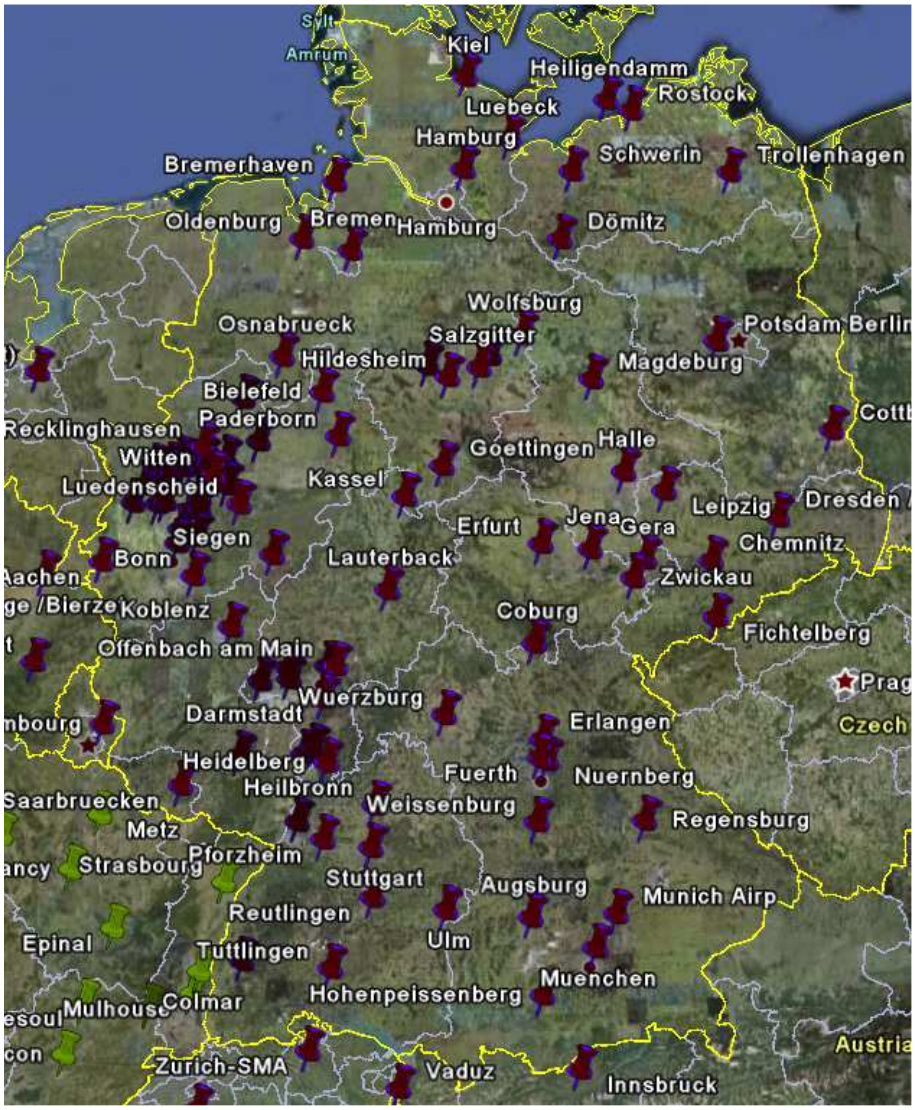

Basic data
Costs
Energy prices
Subsidies
Advance
AC purchase price (full €/kWh) : 0.126
AC purchase price (discount €/kWh) : 0.075
DC purchase price (€/kWh) : 0
AC selling price (€/kWh) : 0.58
AC selling price evolution (%an) 4
DC selling price (€/kWh) : 0
AC Hour price rates
Bonus in the autoconsumption
Bonus in the autoconsumption :
Threshold (%) : 20
Price lower to threshold (€/kWh): 0.4
Price upper to threshold (€/kWh): 0.5



Auto-consumption

Adaptations for PV simulations in Germany:

- Calculation of self consumed energy and auto consumption revenue (see above).
- Addition of 75 new meteo- stations :

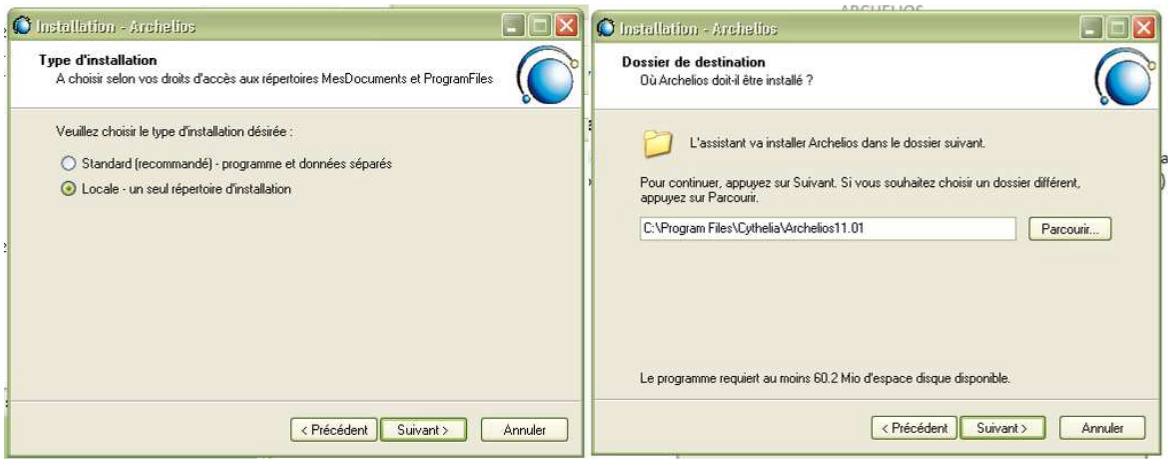


New meteo stations

- Integration of German economic scenarios
- Topological data for automatic horizon mask computation, downloadable here:
  http://www.archelios.fr/gestion/GermanyMaskData.exe

- New email address for German support (feel free to speak German): support.germany@archelios.fr

New option for “local” installation of Archelios: program and data are in a same directory (for non-administrator or restricted users: students, corporate).

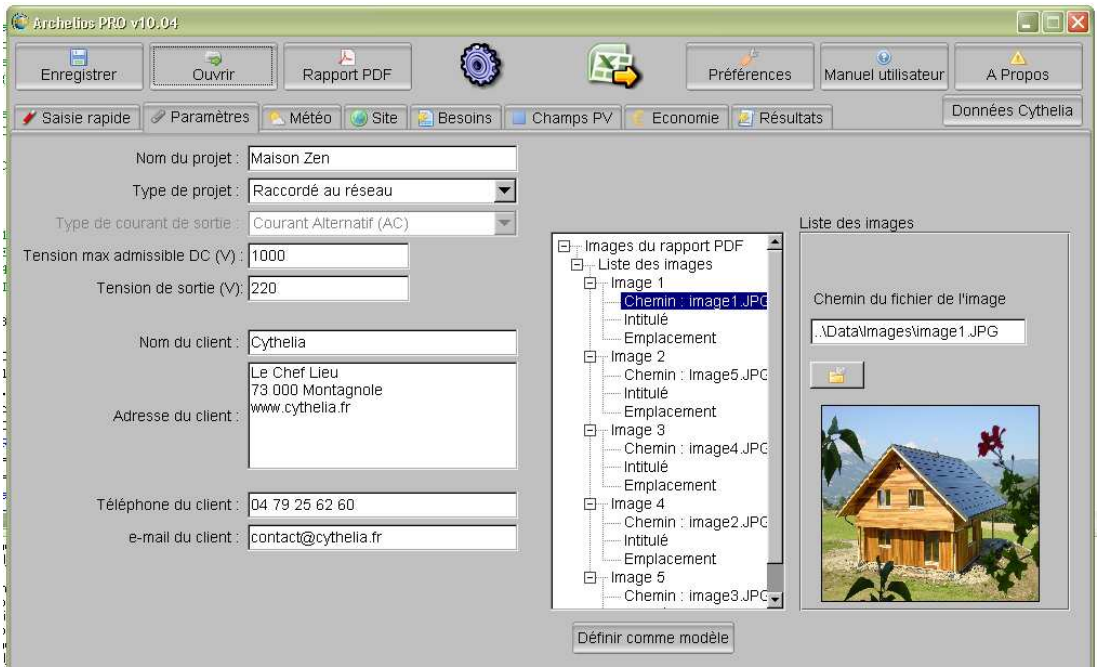

Installation - Archelios
Type d'installation
A choisir selon vos droits d'accès aux répertoires MesDocuments et ProgramFiles
Veuillez choisir le type d'installation désirée :
Standard (recommandé) - programme et données séparés
Locale - un seul répertoire d'installation
< Précédent
Suivant >
Annuler
Installation - Archelios
Dossier de destination
Où Archelios doit-il être installé ?
L'assistant va installer Archelios dans le dossier suivant.
Pour continuer, appuyez sur Suivant. Si vous souhaitez choisir un dossier différent, appuyez sur Parcourir.
C:\Program Files\Cythelia\Archelios11.01
Parcourir...
Le programme requiert au moins 60.2 Mio d'espace disque disponible.
< Précédent
Suivant >
Annuler

Local Installation

2. Software use

Archelios PRO v10.04
ARCHELIOS PRO
Archelios v10.04
© Cythelia 2008/2010
Ce logiciel est distribué sous licence CeCILL telle que publiée par le CEA le CNRS et l'INRIA dans sa version 2.0 du 2006-09-05. Pour davantage de détails, consultez la version complète de la licence CeCILL sur www.cecill.info

After the logo page, the software opens on the tab « Options ».



Above the tabs, we can find the buttons to create a PDF report, get to the preferences, load and save the projects.

2.1 Cythelia database installation

PRO Create an account

The first installation step consists in creating an account on Archelios website : www.archelios.fr

Click on « downloads » and then « buy database »

As a new user you need to identify yourself by creating an account, to do so click « create ».

You will then be prompted to fill out a registration form. You will have to choose an identifier. Your password will be sent to the specified e-mail address.

Buy the databases

Now that your account is created, you can connect to your management interface by clicking on "my account". Your ID and password sent by e-mail are requested.

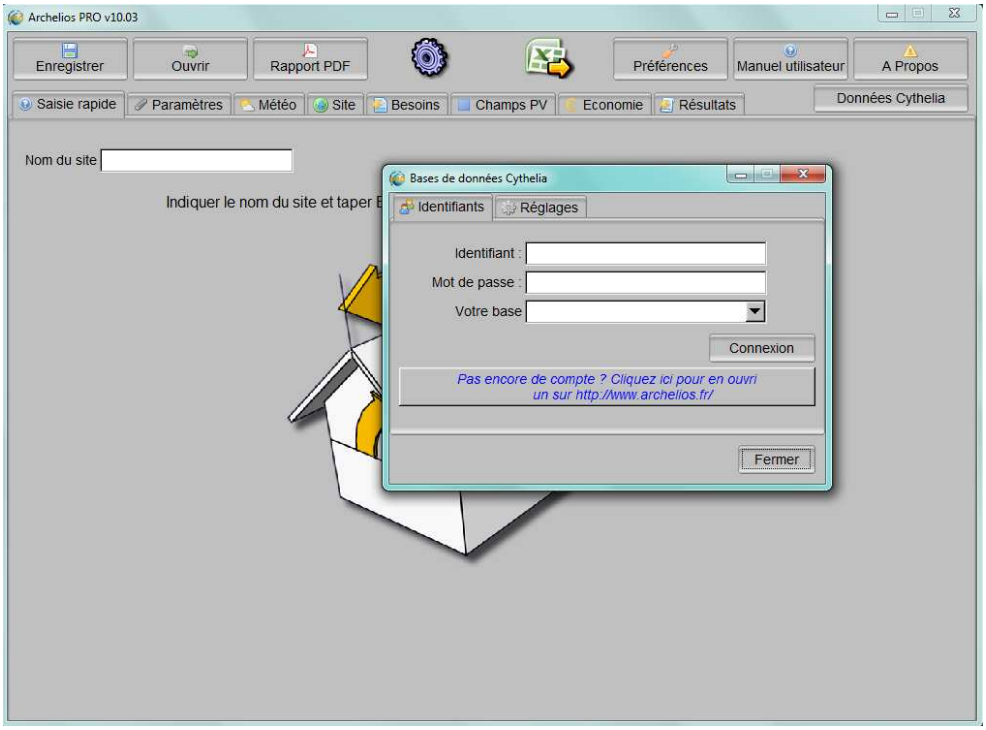
By clicking "Buy databases" you can select the database you want and buy it by clicking "Order" (nb: all databases contain meteorological and material data). The prices depend on the width of the weather basis and the number of computers. This will allow you to pay your purchase online with “Société Générale” secured payment system.

Accueil Contact Mentions légales
ARCHELIOS
Le photovoltaïque en liberté
Qui sommes-nous?
Le projet Archelios
Fonctionnalités
Téléchargements
Achat bases
FAQ
Contact
Mon compte
Mot de passe oublié?
1. Achat base de données 2. Installation 3. Facture
Guide d'achat Coordonnées Mot de passe Déconnexion
Vous disposez de la base de données suivante : 5 postes / Monde : licence de test (30/04/2009)
Postes 1 région France Europe Monde
1
2
5 900,00 € H.T 1170,00 € H.T 1350,00 € H.T 1500,00 € H.T
Pour en savoir plus sur nos tarifs et le contenu des bases de données, cliquez ici.
Remarques :
- Il est possible « d'upgrader » sa base de données. Par exemple acheter une base région puis acheter une base monde. La différence de prix sera alors majorée de 30%.
Etape 1 sur 3
Passer à l'étape suivante >>
Copyright © Cythelia 2008 – Tous droits réservés

Once the payment is done, you can return to your management interface by clicking "Back to the shop."

Download the databases

After payment, you must register your databases in Archelios. Click "Cythelia Data" button.



You must fill in your ID and password and then click "login" (if your computer is connected to the Internet).

You can then associate the computer with the license by clicking on "enable"

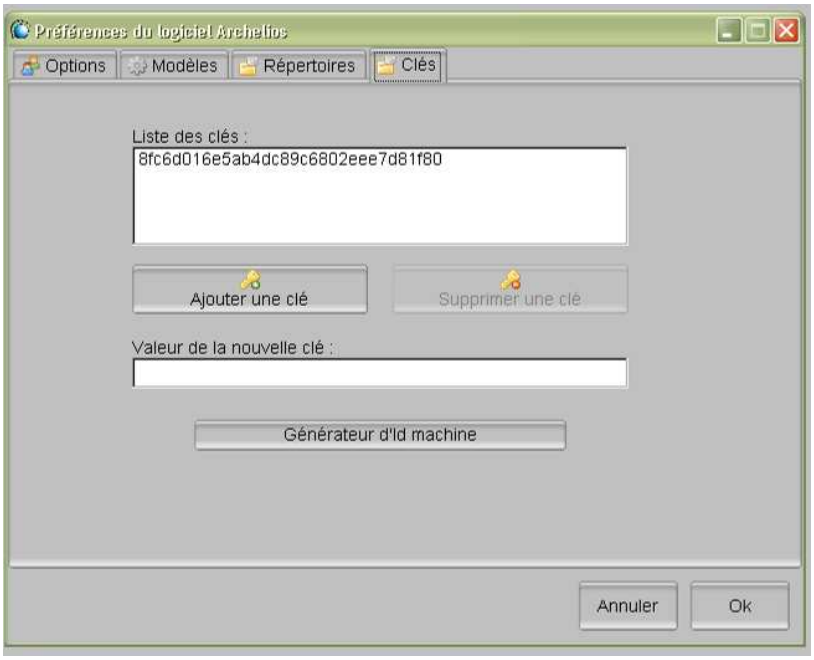
Finally, when clicking on "install", purchased databases will be installed on Archelios.

The process is complete, you will need to restart Archelios in order to load purchased databases.

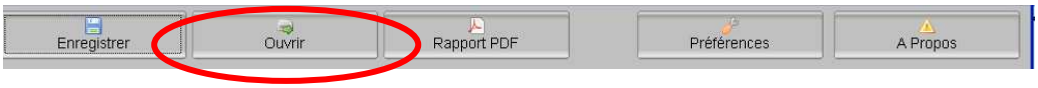
2.2 Settings

This tab enables to choose the language, the diffuse irradiation model, the data base and projects storage configuration.

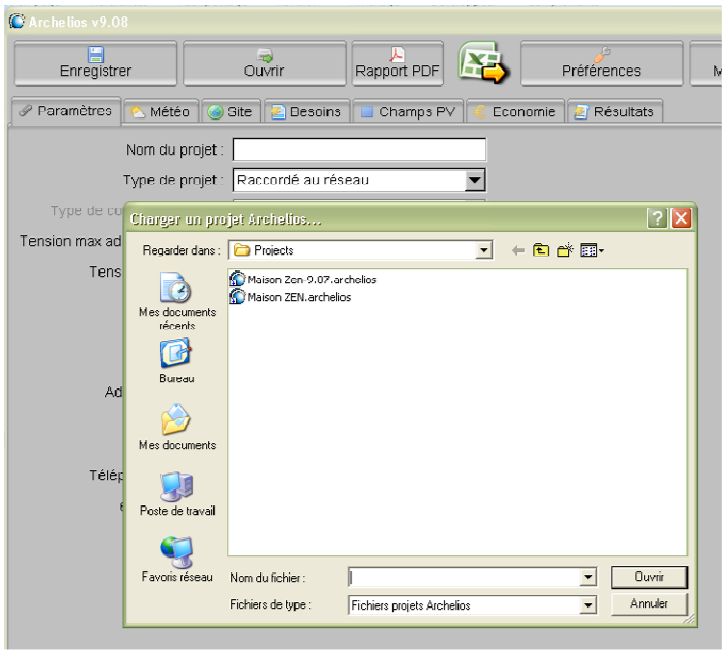
You can also check in the "Keys" tab your databases activation keys. In case of problem you can send your machine id by clicking on the button "machine ID builder» and then "copy and send by e_mail.



2.3 Load/Save a project



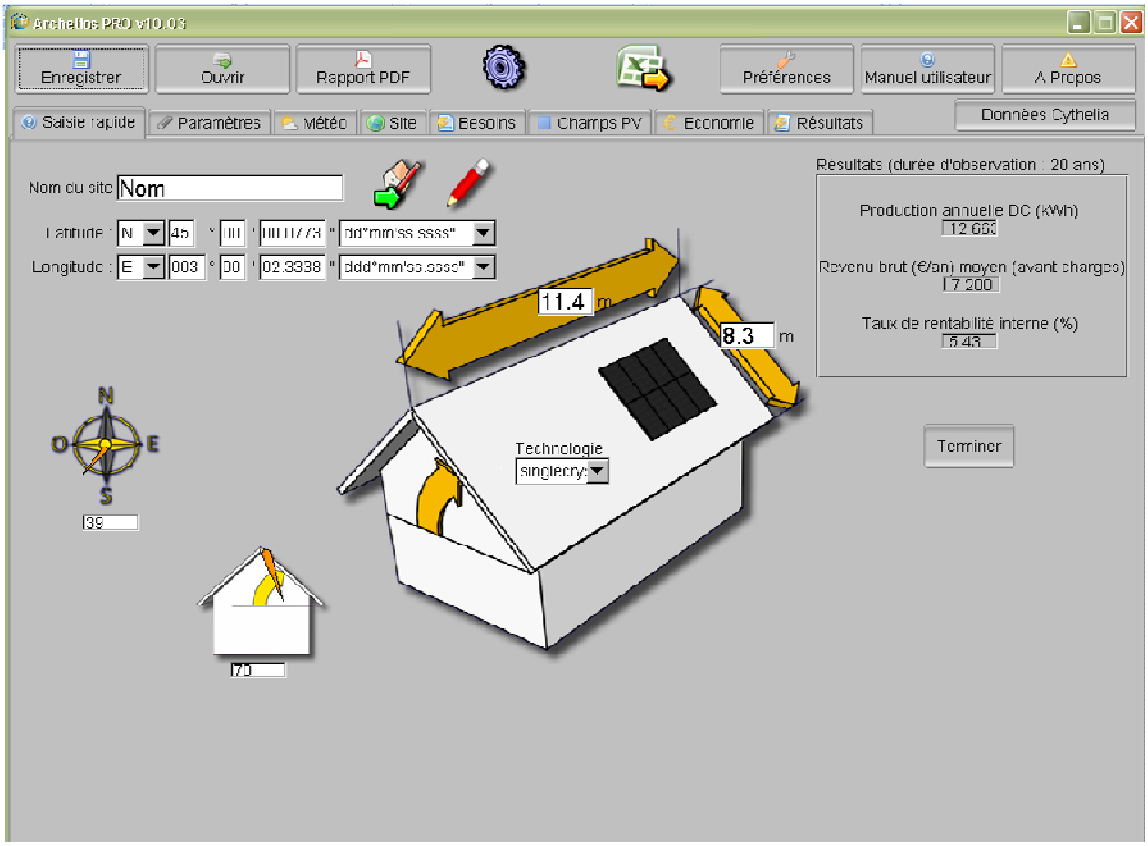
The user can load/save a project with the two buttons at the left of the top of the page.



Open an Archelios Project file

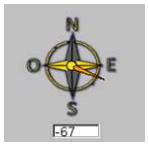
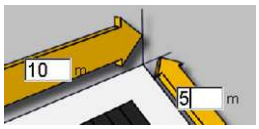
The principle of load/save is the same for all the objects of the software : meteo stations, site, needs, devices, modules, inverters…

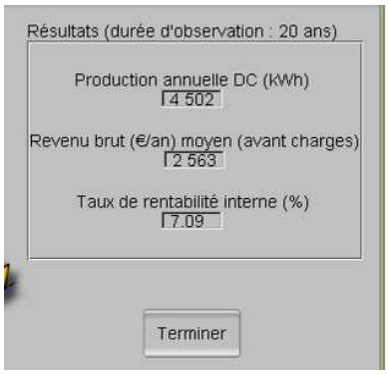
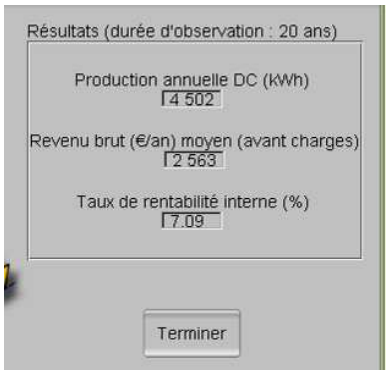
2.4 PRO Fast imput tab



Fast input tab

For the owners of the PRO version of Archelios, the "Fast input" tab allows to quickly set up a project from a few parameters. These parameters are entered into a certain way (fields progressively appear) according to two possibilities "Manual input" or "from a SketchUp file:

Manual input	**From a SketchUp file**
Site name	Site name
Site coordinates	Readen in the SketchUp file
Orientation of the field 	Readen in the SketchUp file
Field dimensions 	Readen in the SketchUp file

Inclination	Readen in the SketchUp file
Module technology	Readen in the SketchUp file
Results computation (« Finish » button) : 	Automatic computation : 

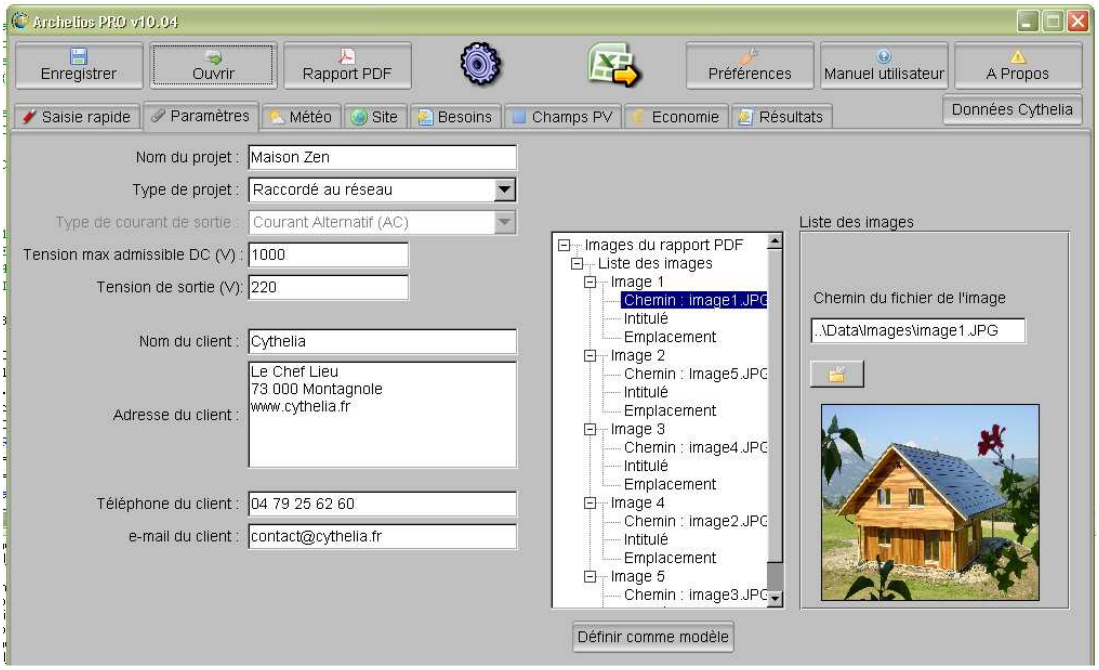
During the results computation the following steps are performed:

- Auto select closest weather station
- Automatic computation of the far mask (if Carnaval is installed)
- Near mask computation (import from SketchUp only)
- Automatic selection of an average module *
- Auto select of an average inverter *
- The economic scenario is selected automatically (from the name defined in the advanced settings)

* You can set the default field (type of module + type of inverter) in advanced settings.

Once the results are displayed you can access all of the project settings.

2.5 Options tab



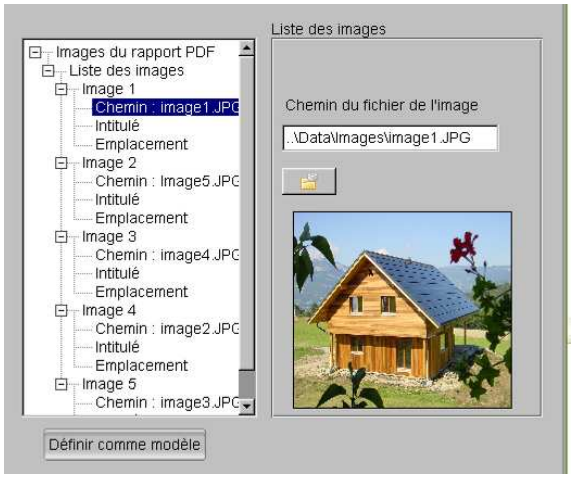
Options tab

In the tab « Options », the user can give a name to the project, set a type (grid-connected…).

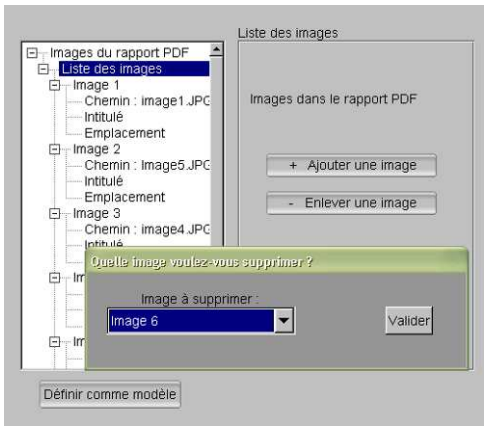
In the case of an off-grid installation, he can define whether he wants direct or alternative current.

The input voltage can be set by the user so that he can define a maximum voltage for the sizing of the photovoltaic array.

PRO Choice of illustrations and comments included in the PDF report:



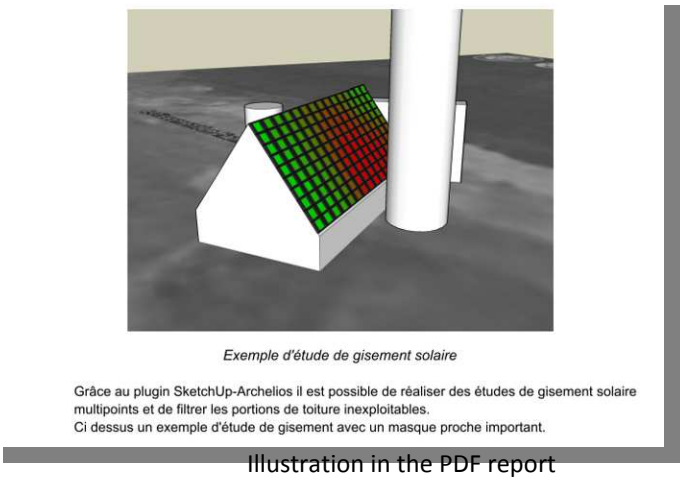
The right side of the settings tab allows you to select one or more images to insert into the PDF report, including the description text.
Adding or removing image is done by selecting "Image list" node in the tree:



Adding or removing image

For each image you can:

- Select the path to the image (jpg or png file)
- Define the text (the first line of text appears centered above the image, the following constitute a paragraph)
- Choose the location of the image in the report: first page, second page (general illustration) or a field description page.

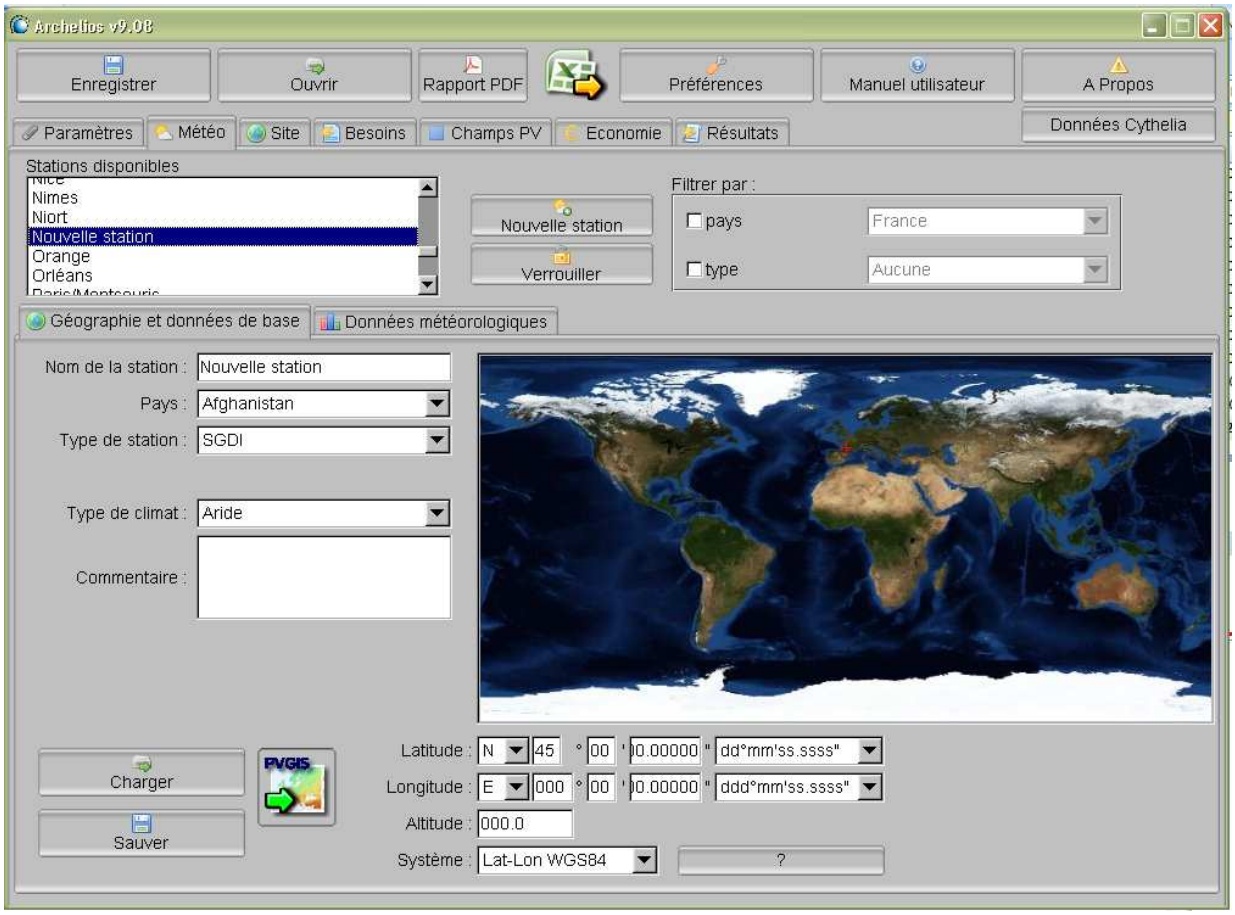


Exemple d'étude de gisement solaire

Grâce au plugin SketchUp-Archelios il est possible de réaliser des études de gisement solaire multipoints et de filtrer les portions de toiture inexploitables.
Ci dessus un exemple d'étude de gisement avec un masque proche important.

Illustration in the PDF report

2.6 Meteo tab



The user can select the meteo station of which data will be used for the project study. It is possible to filter the stations by country or type (S : solar fraction, SG : solar fraction and global irradiation, SGDI : solar fraction, global, direct and diffuse irradiation).

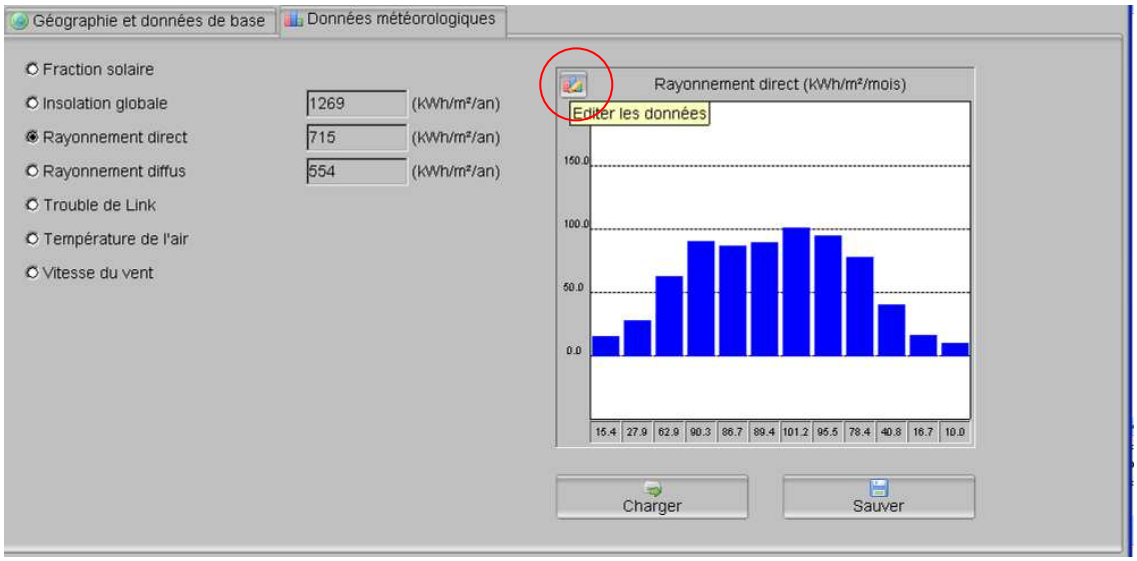
The user can create a new meteo station by clicking on « New station ».

PRO If you have a PRO version you have the ability to import weather data from site PVGis (http://re.jrc.ec.europa.eu/pvgis/apps3/pvest.php#). For more information on this feature please refer to the "Cythelia Plugins" section.

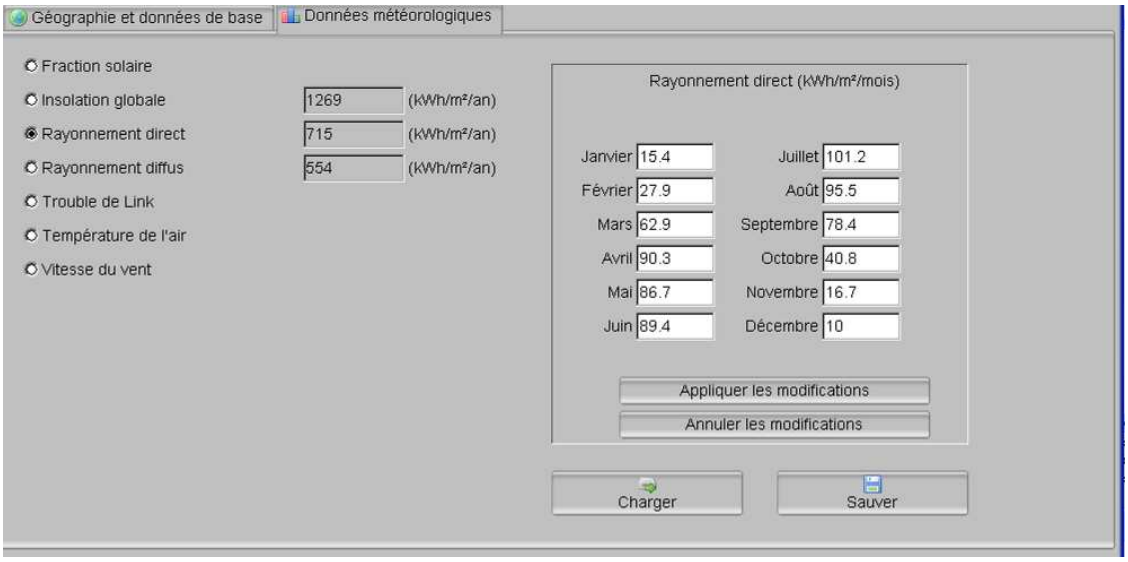
2.6.1 Geography and basic data

This tab enables the user to fill in the software with the data of the meteo station: name, country, type, time zone, climate. Then come the geographical data: latitude, longitude (decimal or sexagesimal) and altitude. The conversion runs automatically when switching the geographical system.

2.6.2 Meteorological data



This tab presents the main meteorological data : solar fraction, global, direct and diffuse irradiation, Link turbidity, air temperature, wind speed. These data are displayed for each month on a graph under which numerical data are available and modifiable.



The modifications can be saved with the button « Save » at the right of the down of the page.

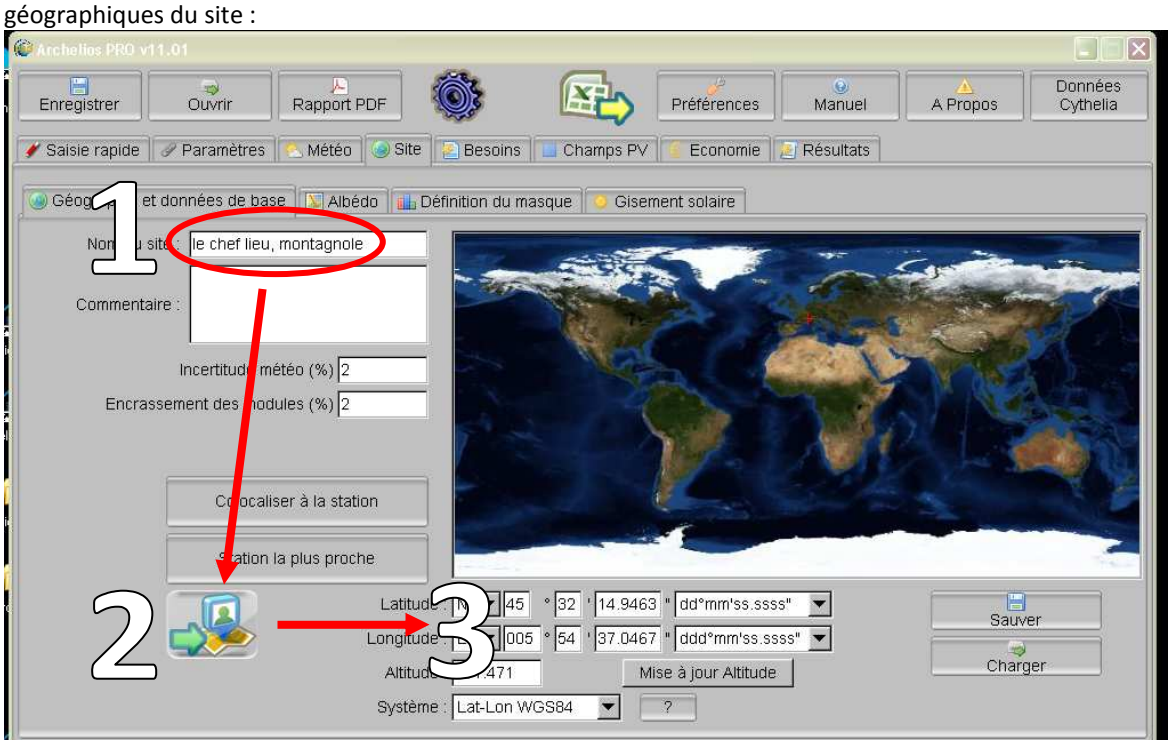
[1] Lorsque l'utilisateur ne dispose d'aucune donnée, il peut en entrant le type de climat, retrouver des valeurs qui correspondent à une moyenne de plusieurs stations du climat considéré. S'il ne dispose que de données partielles, par exemple que des données d'irradiation, en choisissant un type de climat, la station météo sera renseignée avec les troubles de Link, température et vitesse du vent correspondant à la moyenne climatique.

If you have a PRO version you can export the weather data in csv (compatible excel) format. For more information on this feature please refer to the "Cythelia Plugins" section.

2.7 Site tab

2.7.1 Geography and basic data

L'utilisateur peut aussi depuis la version 11.01 faire appel à Google Maps pour la récupération des coordonnées géographiques du site :



Appel à Googlemaps pour la saisie des coordonnées du site

Once the meteo station is selected, the location of the photovoltaic array has to be defined. This step consists in entering the geographical coordinates and the altitude of the site. Archelios calculates automatically the horizon (with Carnaval) and perform an altitude correction.

Click on the button "New site", then "Unlock" and fill in the datas.

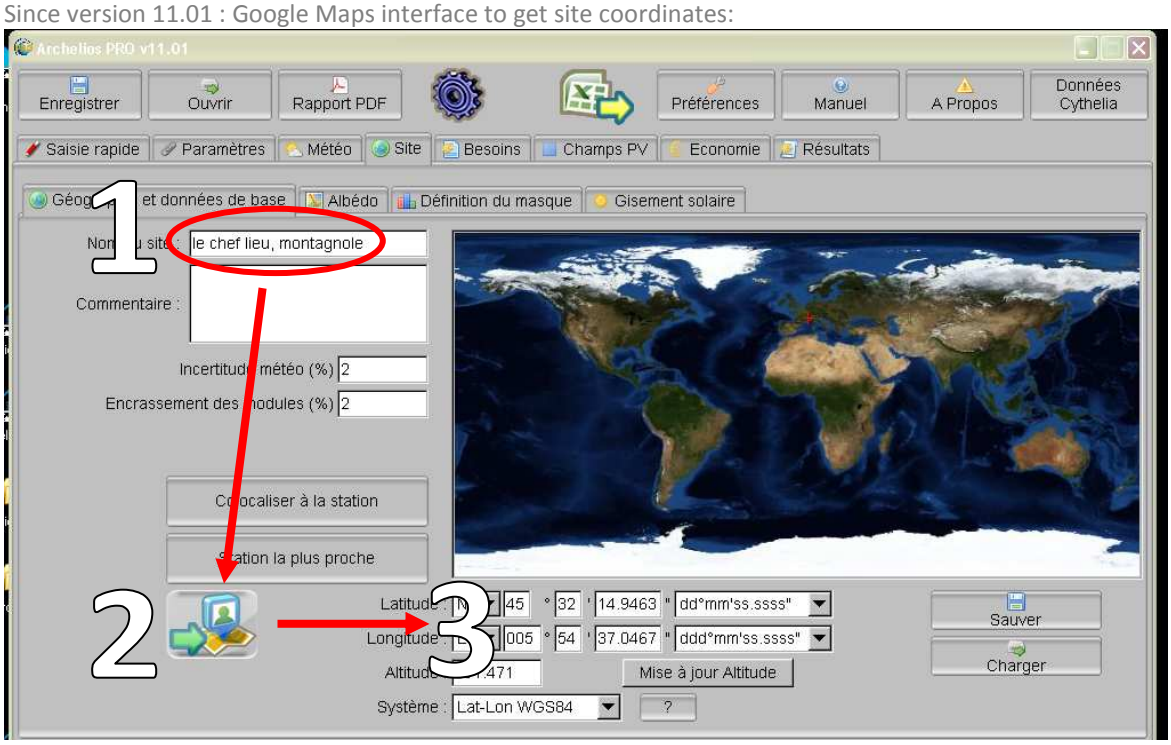
If the location of the site corresponds to the location of the meteo station, it is possible to position the site to the station.

The following loss characteristics can be set by the user:

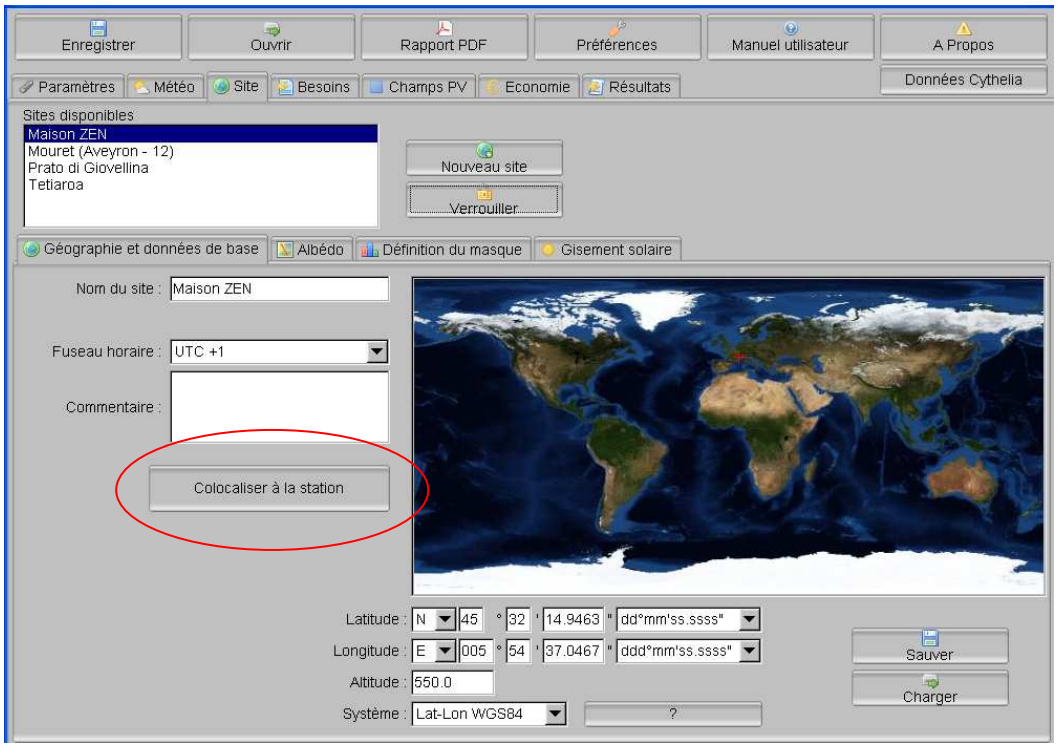
- Weather uncertainty to take into account the fact that data are a little too optimistic
- Modules dirt to take account of the immediate environment uncertainty (dust, frequent rains, etc.)

[2] Attention, cette correction n'est plus valable au-delà d'une certaine limite qu'il convient d'apprécier selon les cas. Cf. la partie sur les modèles.

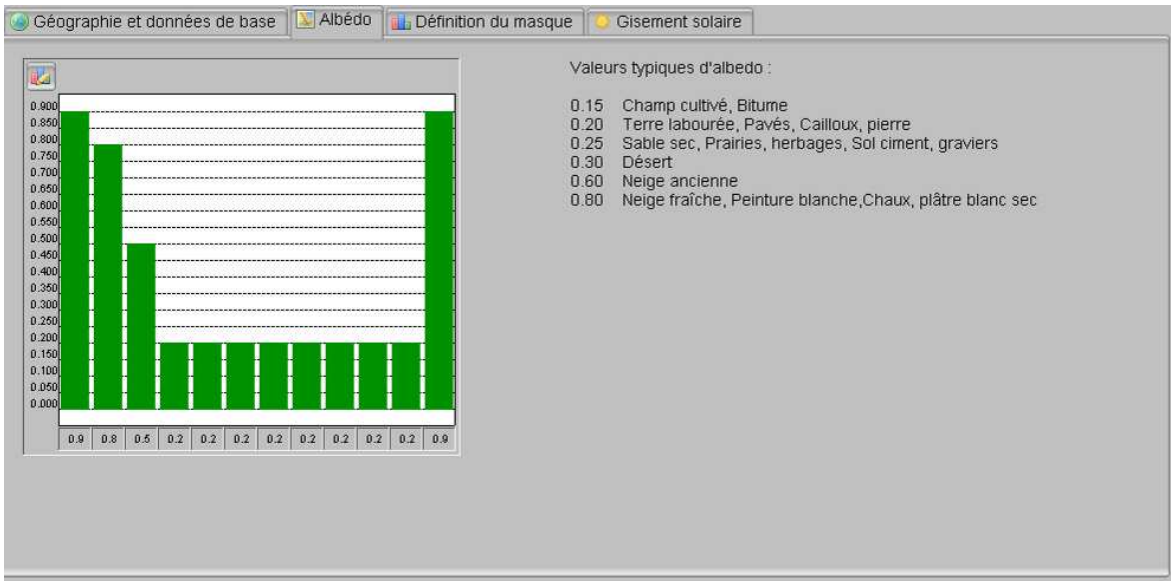
Since version 11.01 : Google Maps interface to get site coordinates:



Googlemaps button



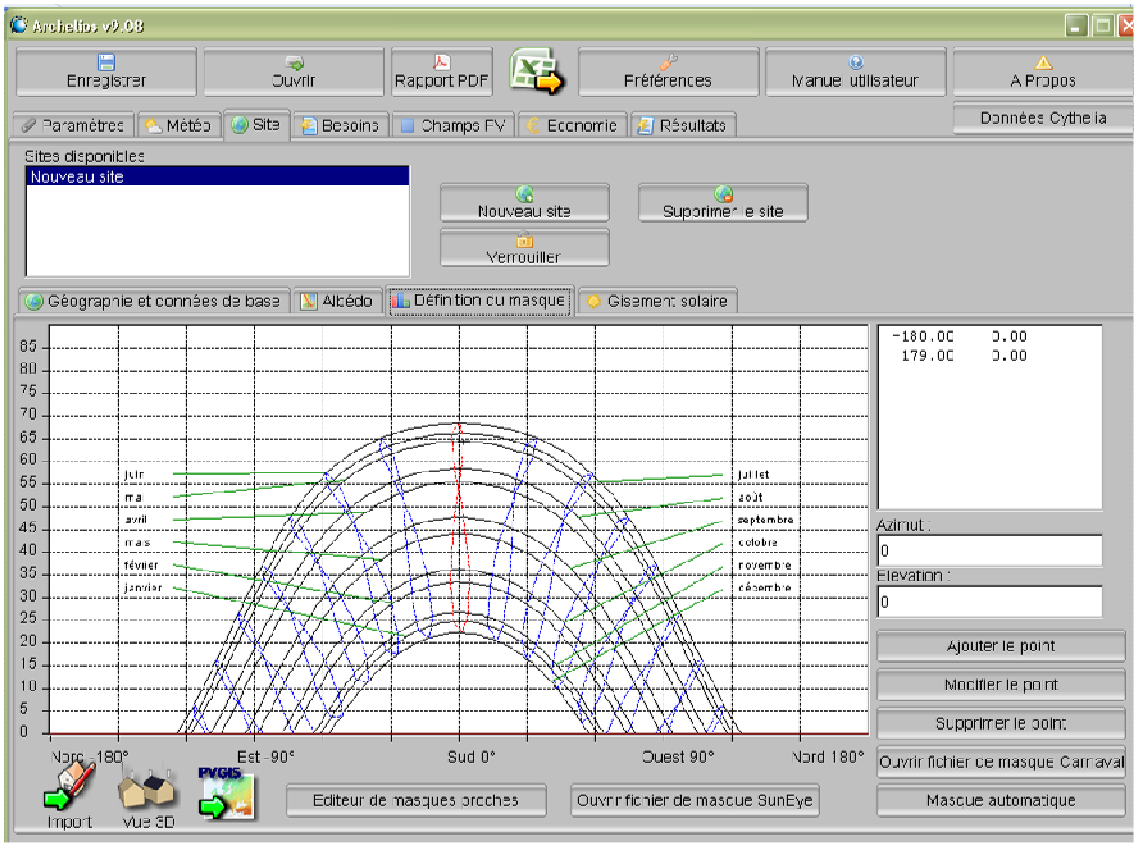
2.7.2 Albedo


Géographie et données de base
Albédo
Définition du masque
Gisement solaire
Valeurs typiques d'albedo :
0.15 Champ cultivé, Bitume
0.20 Terre labourée, Pavés, Cailloux, pierre
0.25 Sable sec, Prairies, herbages, Sol ciment, graviers
0.30 Désert
0.60 Neige ancienne
0.80 Neige fraîche, Peinture blanche,Chaux, plâtre blanc sec

This tab enables to set albedo values monthly. Albedo's default value is 0,2.

Typical values are given at the right. The edition of the values is made by cliking on the button on top at the left.

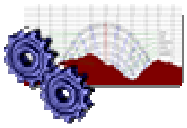
2.7.3 Mask definition



It is possible to see the sun path for each average day of the month.

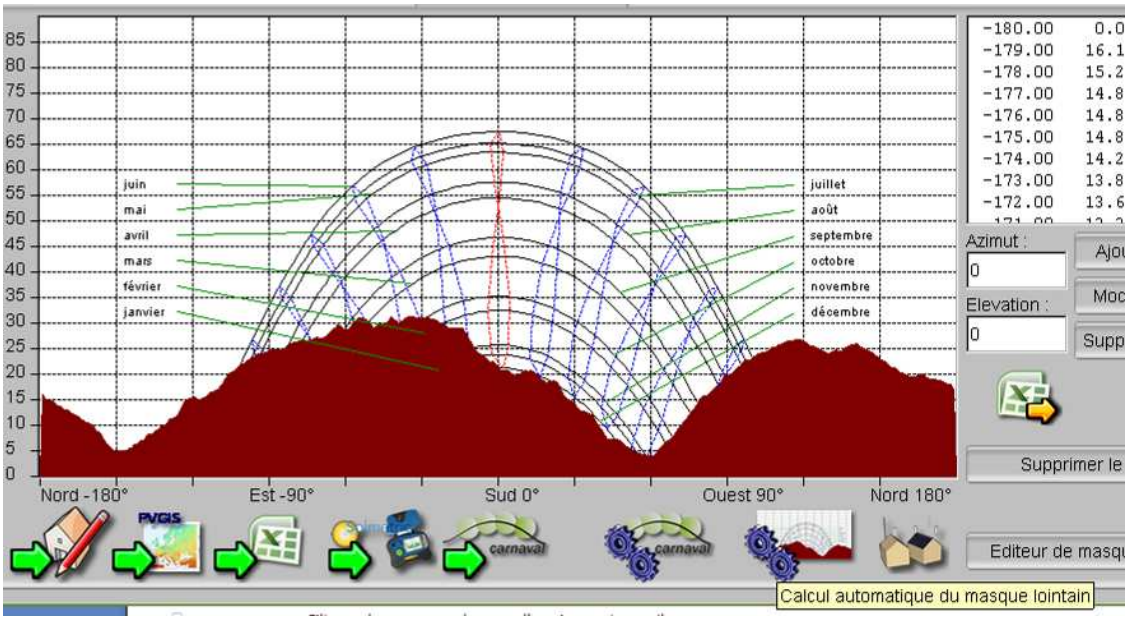
The mask can be entered for each point with the azimuth and its elevation.

2.7.3.2 Automatic horizon mask computation



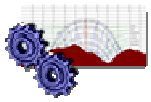
The calculation of the horizon mask can be done directly by using the automatic calculation functionality.

This functionality relies on SMRT data collected during a NASA mission and interpreted by the CGIA[R 5].



Automatic horizon computation

Once site coordinates are entered you can compute automatically the horizon mask by pushing the



button.

---

[3] Cf. la partie du manuel sur les modèles utilisés

[4] Jarvis A., H.I. Reuter, A. Nelson, E. Guevara, 2008, Hole-filled seamless SRTM data V4, International Centre for Tropical Agriculture (CIAT), available from http://srtm.csi.cgiar.org.

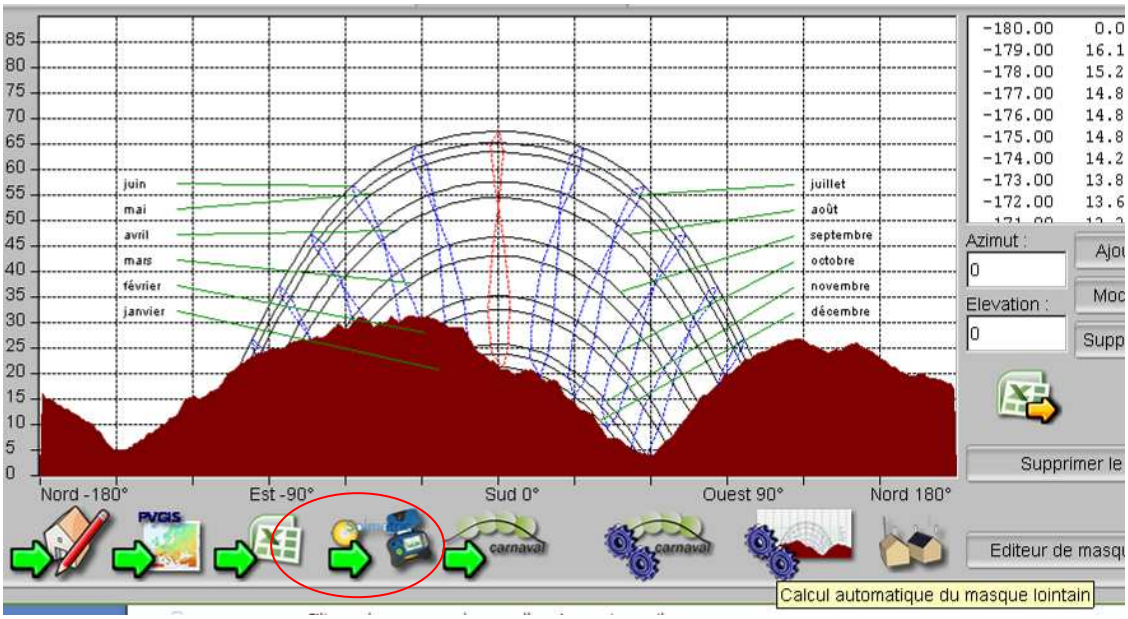
The fifteen CGIAR International Research Centers have pioneered the application of Geographic Information Systems (GIS) and Remote Sensing (RS) for sustainable agricultural development for more than a decade. In May 1999, they formed the Consortium for Spatial Information (CGIAR-CSI) which links the all of the CGIAR's GIS/RS laboratories, and the many geospatial scientists and researchers within the CGIAR system, with scientists and institutions from around the world. Together, these laboratories, scientists and researchers constitute a formidable assemblage of technical ingenuity, scientific expertise, and practical experience in spatial analysis.

They have already developed important collections of data on population, poverty, climate, soils, crops, livestock, transportation, and biodiversity and other geospatial Global Public Goods. The CGIAR-CSI researchers are continuing to break new ground in the integration of biophysical and socio-economic data to better target agricultural technologies and resources to farmers' needs, to assess global needs, develop strategies to alleviate poverty, and to better adapt to a changing global environment.

NB: For outside metropolitan France calculations it is necessary to download the data mask from the site: www.archelios.fr

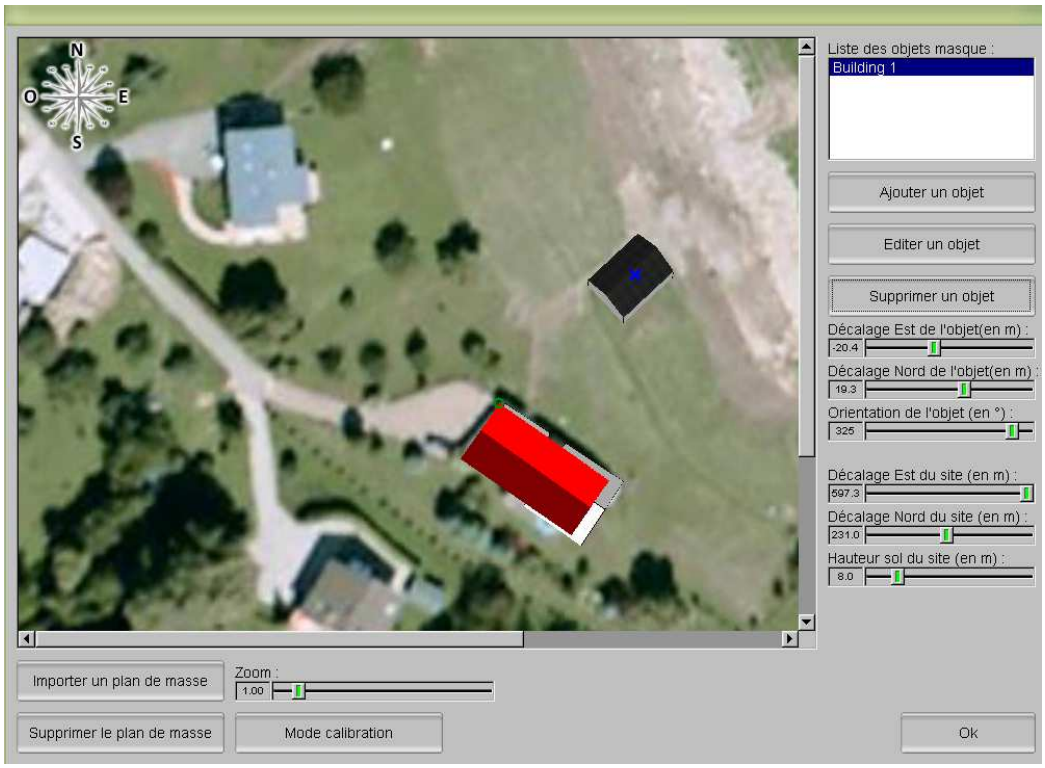
Inside France, calculation can also be made by Carnaval freeware.

It is also possible to open a mask file generated on another computer by Carnaval for instance



You can also import a mask in CSV format from Suneye (www.solmetric.com), a masks measuring system.

Close mask can be set with the close mask Editor or by importing 3D data from Google SketchUp.



Close mask Editor

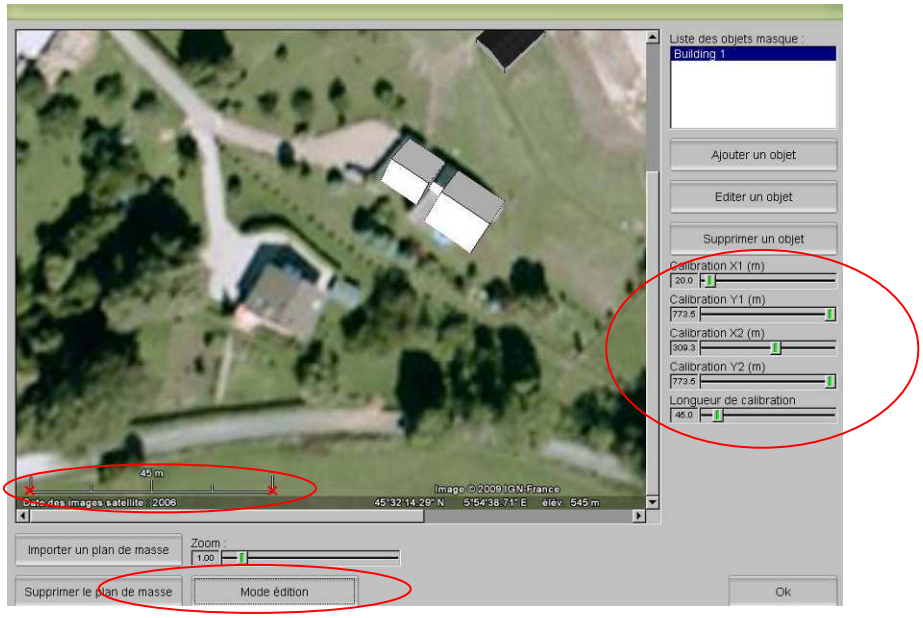
Close mask definition:

- Background import: select the jpeg file representing the site background on your disk. This file can be a screen capture coming from a web site (i.e. Géoportail (http://www.geoportail.fr/)), a software (i.e. Google Earth (http://earth.google.com/intl/fr/) or a paper plan scan.

Attention: the North must be oriented vertically upwards. The background image must contain a scale to allow its calibration.

- Background calibration: button "calibration mode".

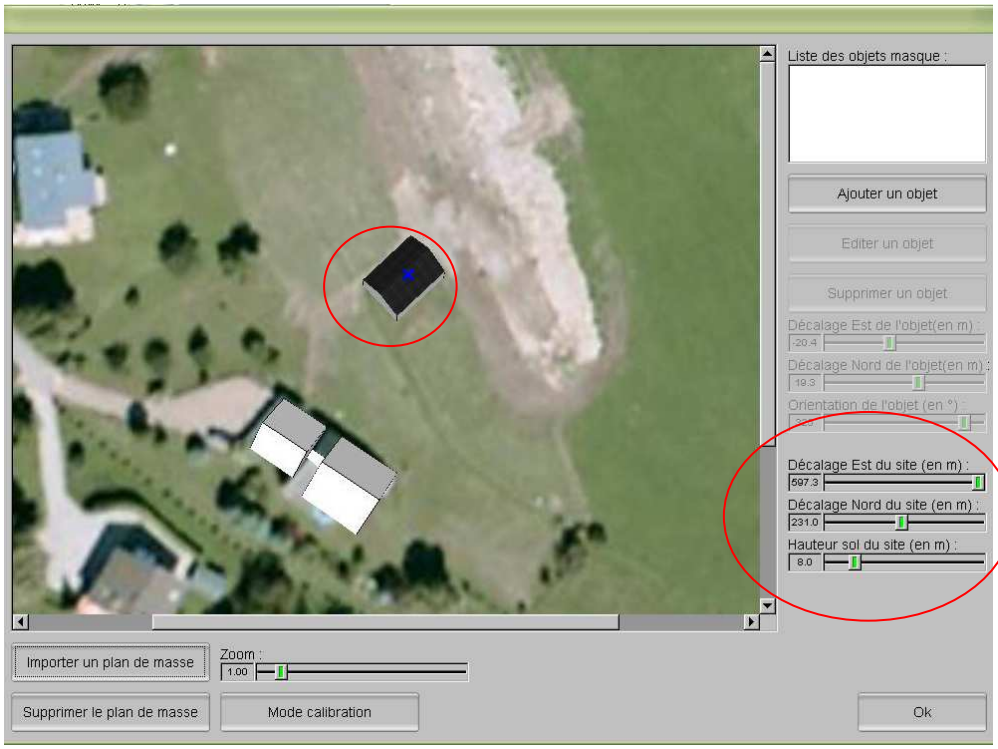
The two Red Cross should be positioned at the ends of the scale bar (use of the "Calibration X 1, Y1, X 2, Y2" cursors). The real length of the scale bar is entered with cursor "Calibration length."



Background calibration

- PV field center definition:

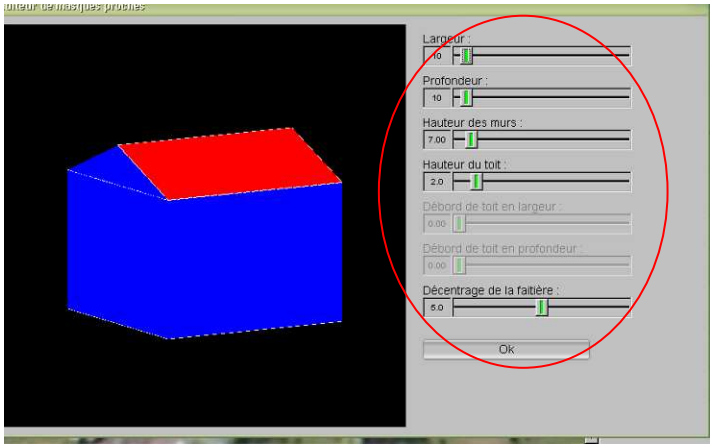
The cursors "offset North and East of the site" and "Site height" allow you to position the center of the future PV filed (see illustration below).



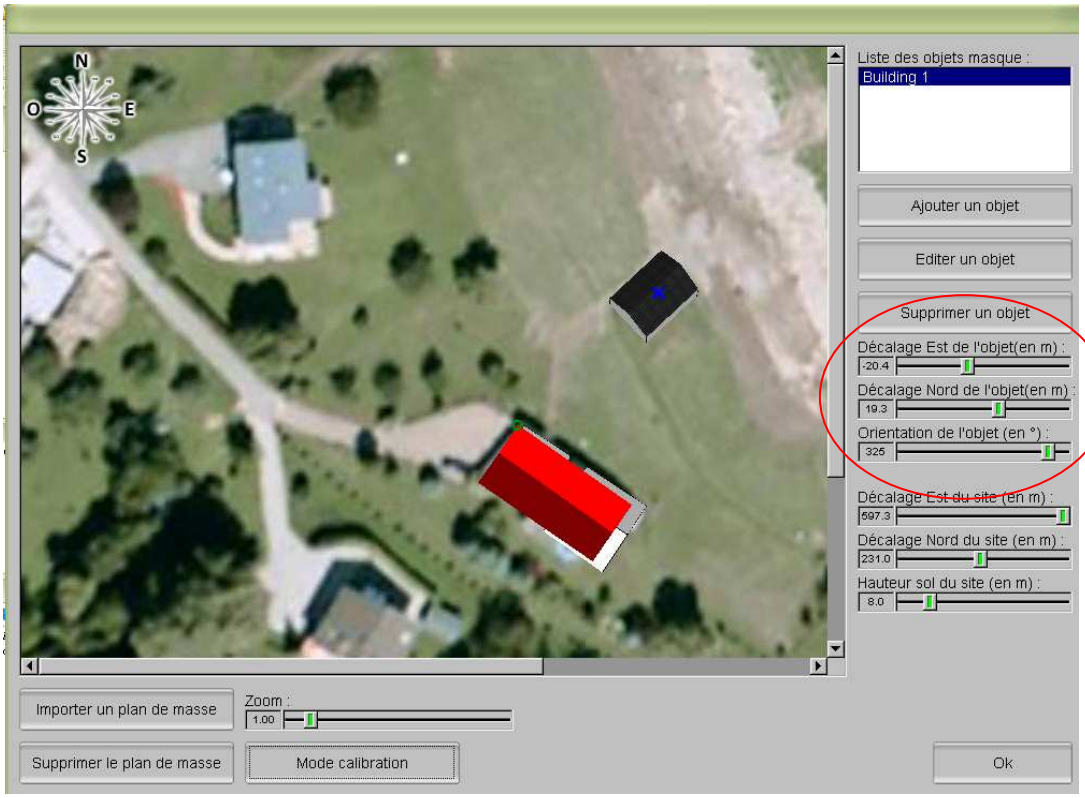
PV field center definition

- Mask definition:

Click "Edition mode" to return to the mask Object Editor. Mask objects (buildings) are created by clicking the button "add an object". Each object dimensions are configurable by clicking the button "Edit", the position of each object is entered with the sliders "offset East and North, object orientation".



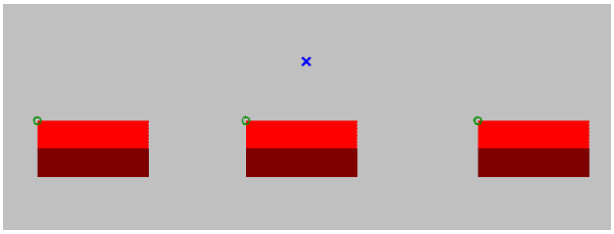
Dimension of mask objects)

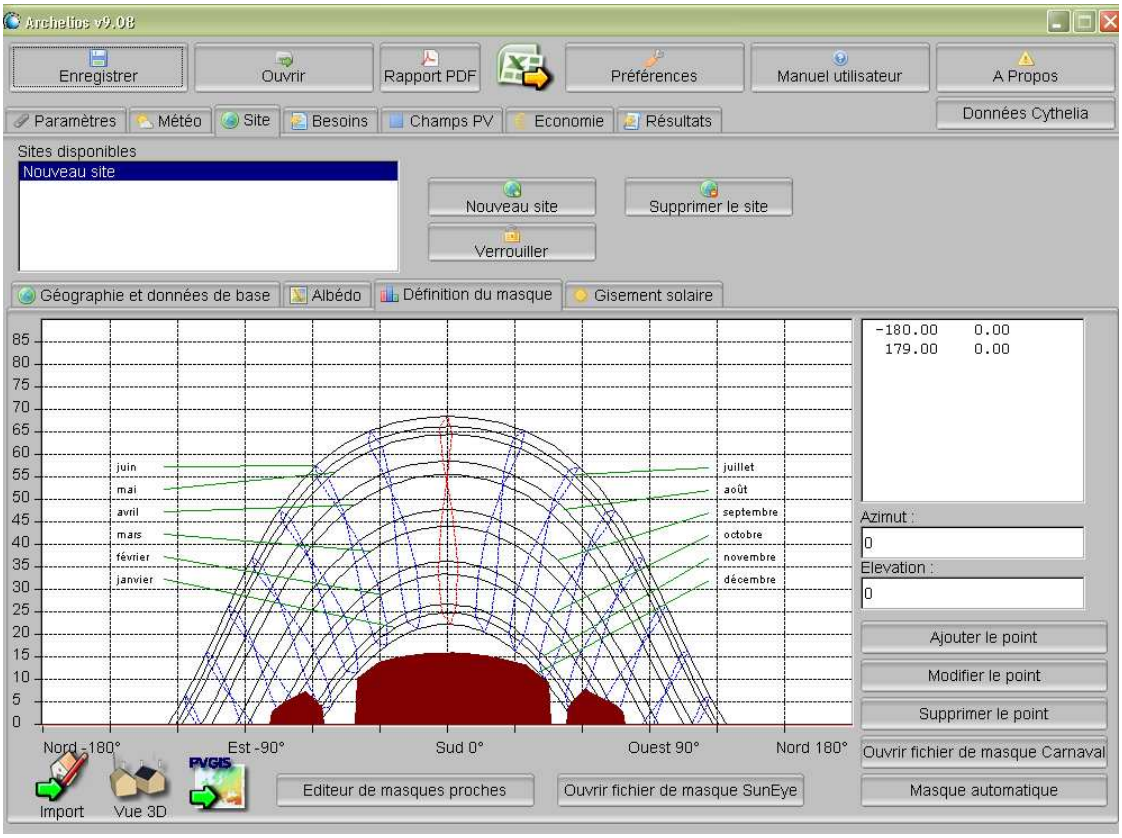


Positionof objects

- Close mask computation :

When the close mask editor is closed (OK button), the close mask is automatically computed.





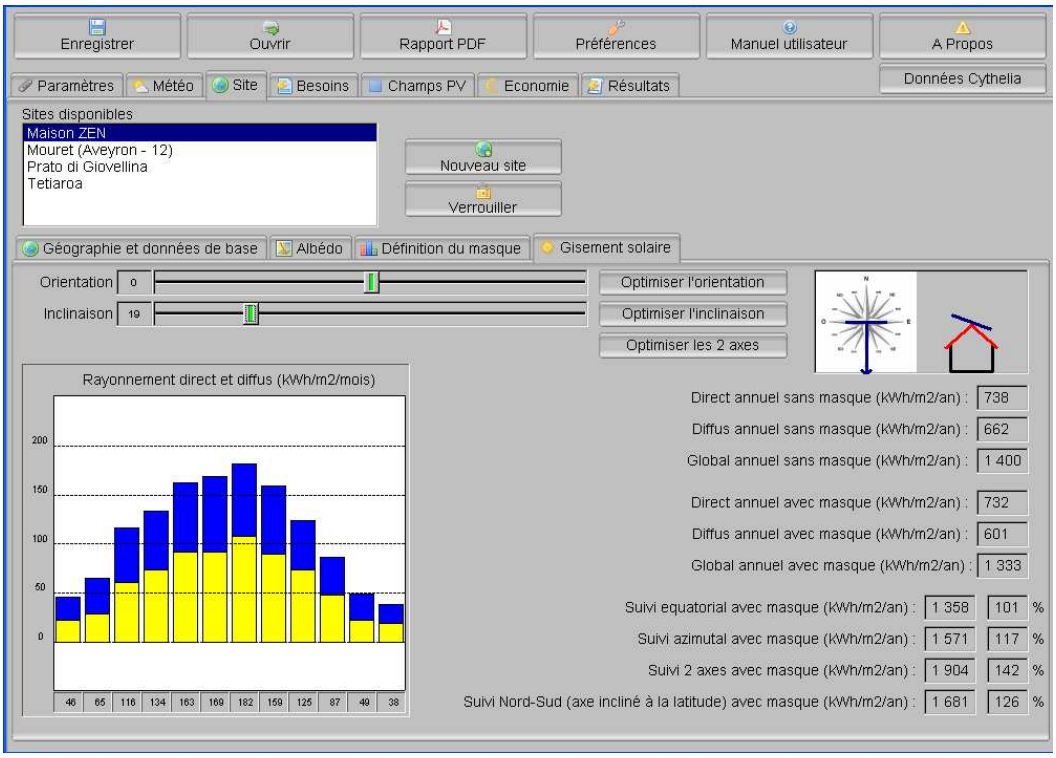
Close mask example (3 buildings)

For the computations a global mask is computed:

Global mask = close mask + horizon mask

PRO If you have a PRO version you can import near mask from a Google SketchUp © file or PVGis site (http://re.jrc.ec.europa.eu/pvgis/apps3/pvest.php#). For more details on these features please refer to the "Cythelia Plugins" section.

2.7.4 Solar resource



This tab enables to see the solar irradiation on a surface at any orientation and inclination, with or without mask, as well as for three types of tracking (equatorial, azimutal, two axis). A compass card for the orientation and an house with a panel for the slope give the assurance to the user that he doesn't mistaken.

The graph on the left gives the direct and diffuse irradiation monthly, corrected by the mask influence. The numerical value appears passing upon the graph.

The user can switch from a diffuse transposition model to another (Perez, 1990 or Hay and Davies, 1980) at the tab "preferences".

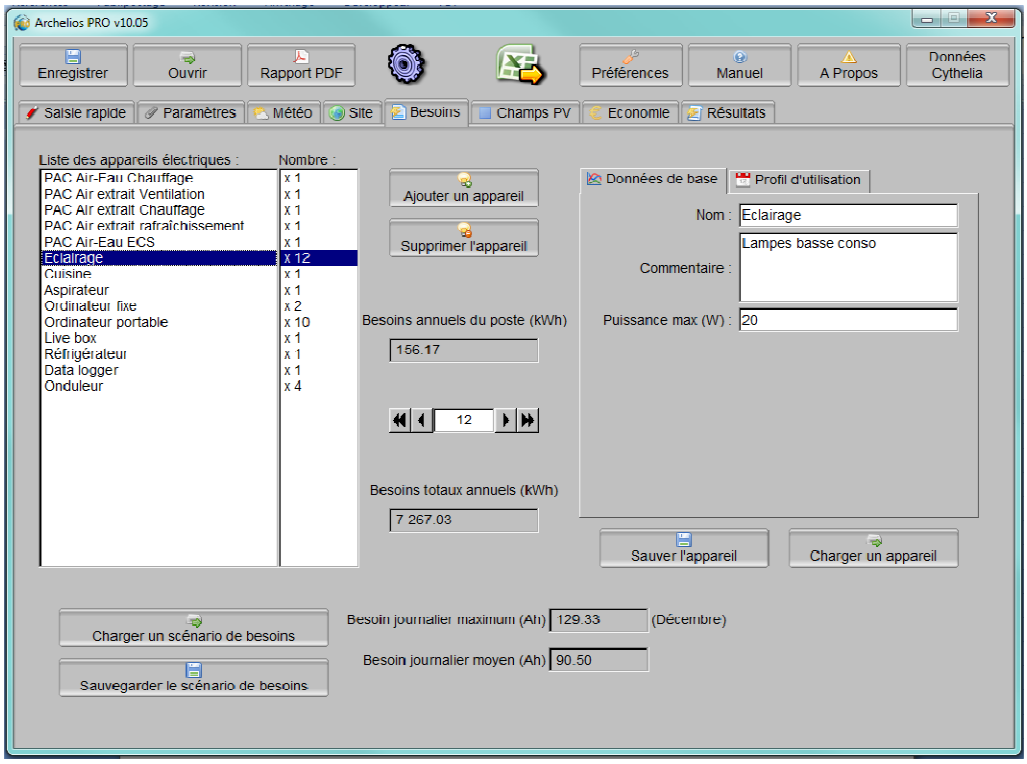
One can optimise the orientation and slope by clicking on the corresponding buttons.

At the right is given the solar resource with and without mask so as the user can see its influence, as well as the solar resource for three types of tracking.

PRO If you have a PRO version you can export the weather data in csv (compatible excel) format.

For more information on this feature please refer to the "Cythelia Plugins" section.

2.8 Needs tab



In this part, you can set the electrical needs.

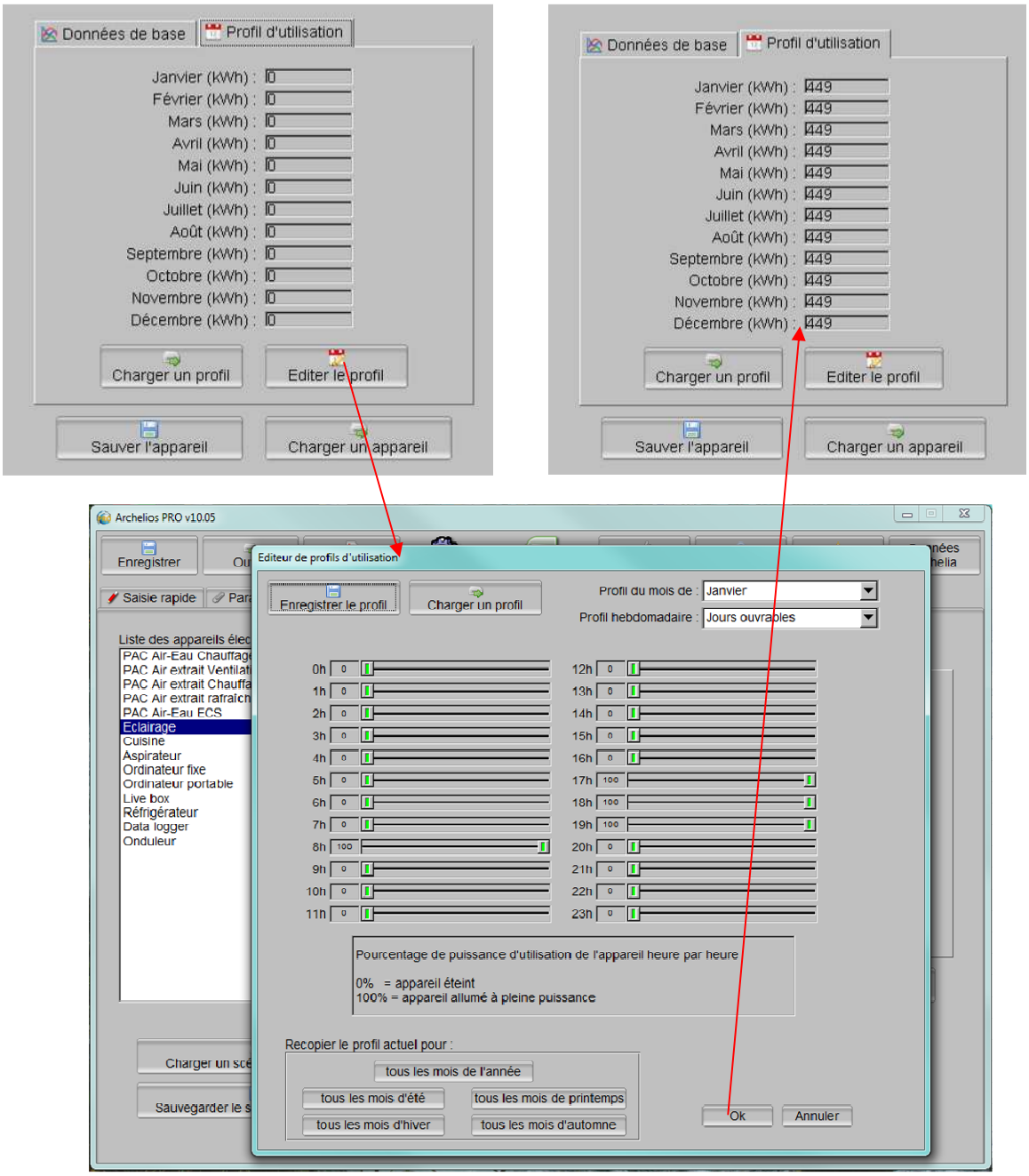
You can add as devices as needed and define their number, their power characteristics and the usage profile.

To add a device, you just need to click on the button “Add a device”. The buttons “Basic data” and “Usage profile” appear on the right, as well as a button to define the number of devices.

“Basic data” enables to set the name and the power of the device.

We can see easily global consumption device by selecting it. We also have the maximum daily need (Ah), the month, and the average daily need (Ah) in the year.

When clicking on “usage profile” you can access to device monthly needs.

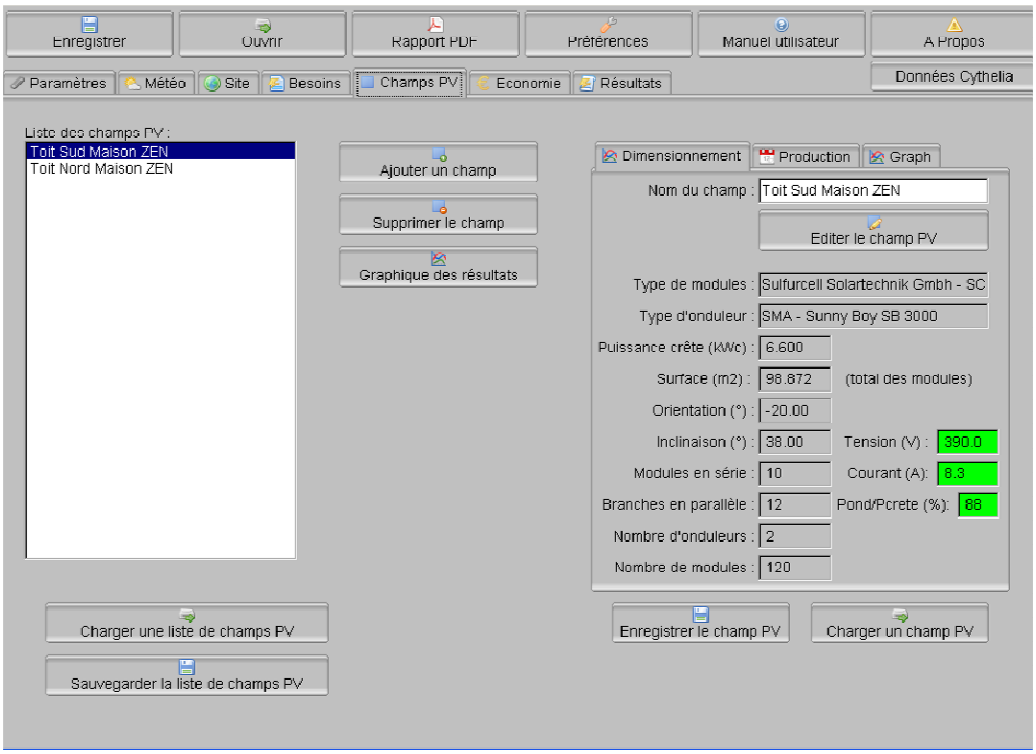


It is possible to define an hourly usage profile for each month applicable for all the days of the week, only for the week-end or for working days.

It is possible to copy a profile of a month to all the year or for the summer month (July, August, September) and winter month (January, February, March) and spring month (Abril, May, Jun) and autumn month (October, Novembre, December).

When several devices and their respective profiles are entered, it is possible to save them in a unique needs scenario.

2.9 PV Fields Tab



It is possible to create as many PV field as he user need. After having giving a name to the field, the user has to edit the field.

First, the user has to select the module (he can apply a filter by manufacturer, technology and power).

2.9.1.2 Direct access to elements

The user can also to click directly in the list of the available modules, and to type manufacturer's name. The list updates automatically to select manufacturer's modules. One tooltip informs about the search.

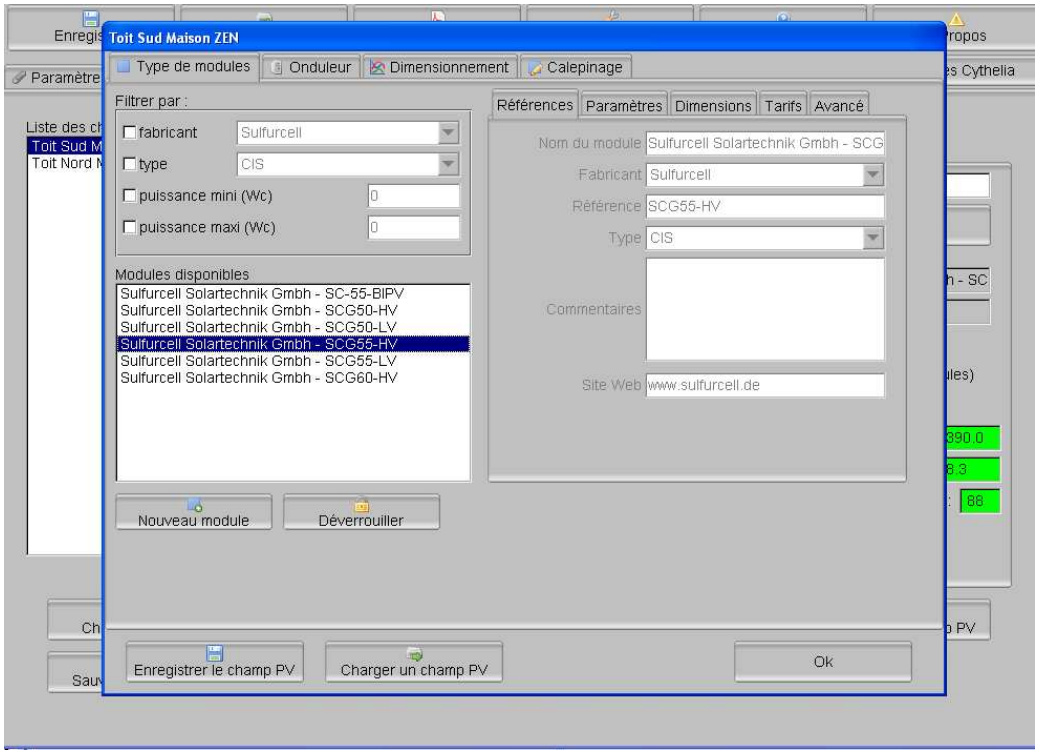
Modules disponibles
SORGENIA SPA - SLX-M180-60-215
SORGENIA SPA - SLX-M180-60-225
SORGENIA SPA - SLX-M180-72-160
SUN
SORGENIA SPA - SLX-M180-72-180
SUNAGE S.A. - SAM 72-5-185
SUNAGE S.A. - SAM 96-5-220
SUNAGE S.A. - SAM 96-5-230
SUNAGE S.A. - SAM 96-5-245
SUNAGE S.A. - SAM Albedo 77-55
Saiphil Sunny s.r.l. - Comitini-170

Module characteristics are displayed on the right. As for the meteorological data, it is possible to create a new module and/or to modify an existing module.

When the NOCT is not specified by the manufacturer, it is fixed at 50°C and the box is blue.

Following loss characteristics may be fixed by the user:

- Dispersion characteristics or mismatch.

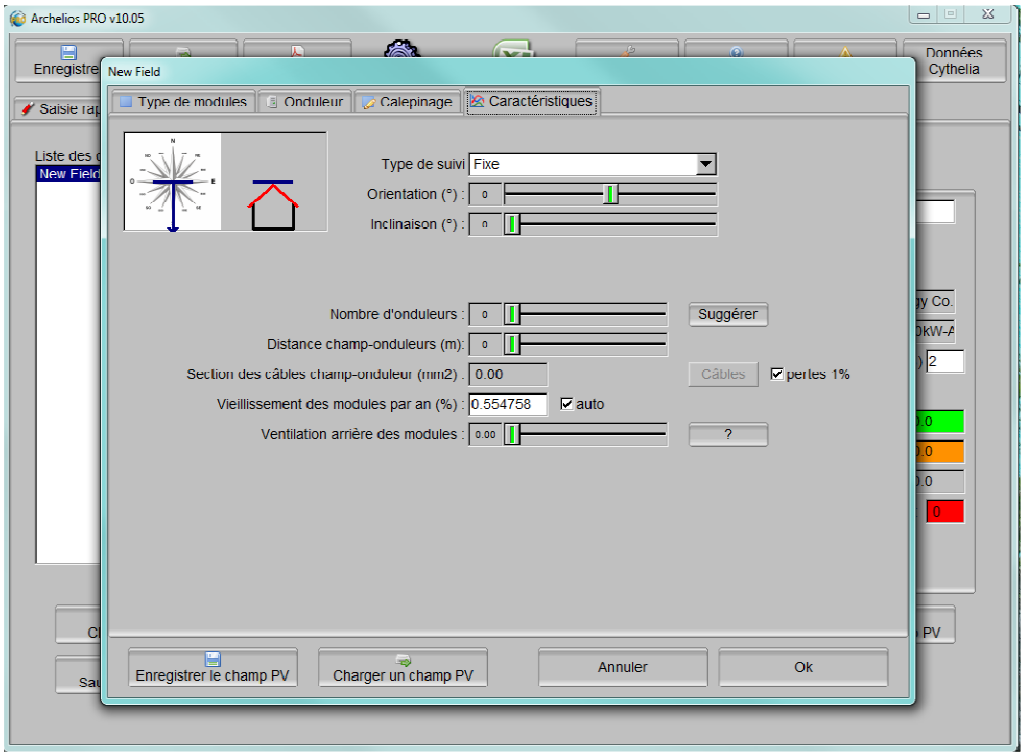


The inverter choice is similar to the module choice.

In remote configuration, the tabs battery and regulator appear.

The tab “Sizing” allows the choice of orientation and slope, numbers of modules in serie and parallel, number of inverters.

In order to take into account the aging of the modules, the user can fill an average aging coefficient during the economical observation period. B ticking he box “auto”, the software calculates a coefficient from the guarantee of performance given by the manufacturer (tab “Advanced” of “Type of modules”)

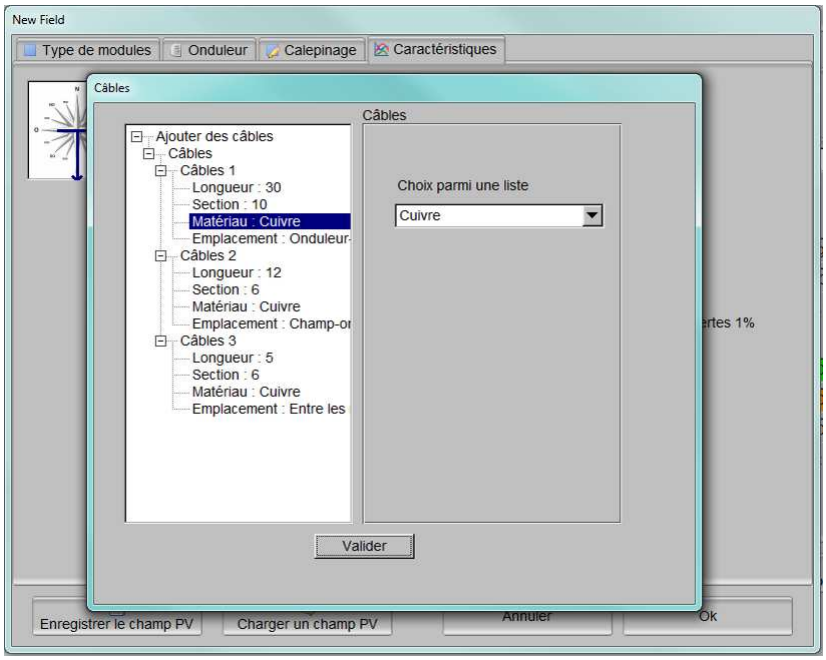


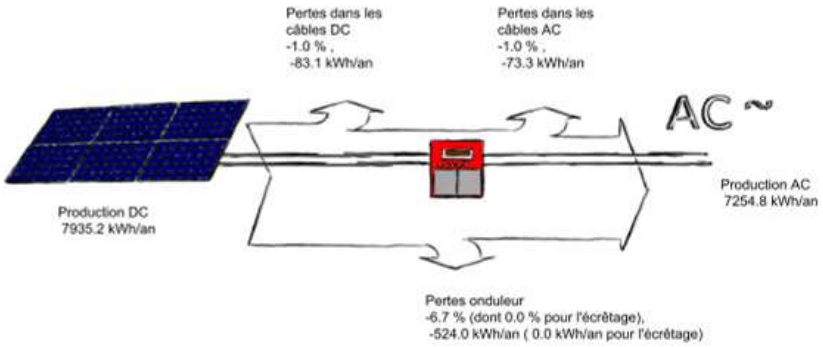
2.9.1.3 Cable losses :

Archelios gives an indication about the cable section to use between the PV array and the inverter so as the loss stay under 1%.

Archelios also allows defining exact lengths of cables (between PV modules, between modules and inverter or between inverter and delivery point), section (mm²) and material.

Then Archelios can calculate hour per hour the cables losses (DC and AC).





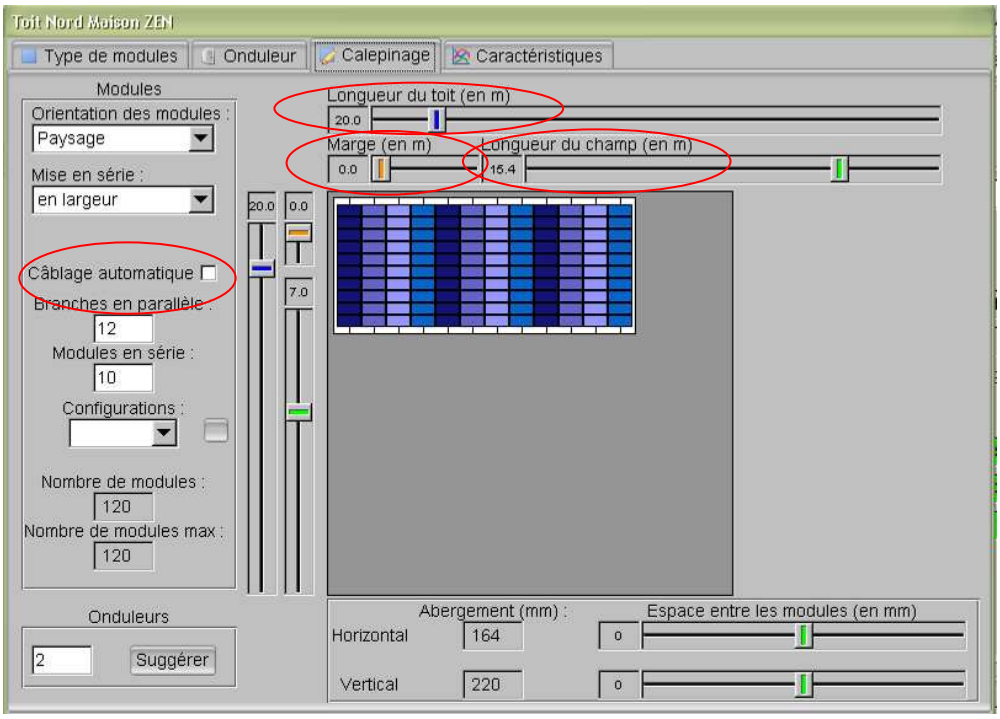
The tab « sizing wizard » enables to calculate the maximum number of modules fitting a given surface, taking into account:

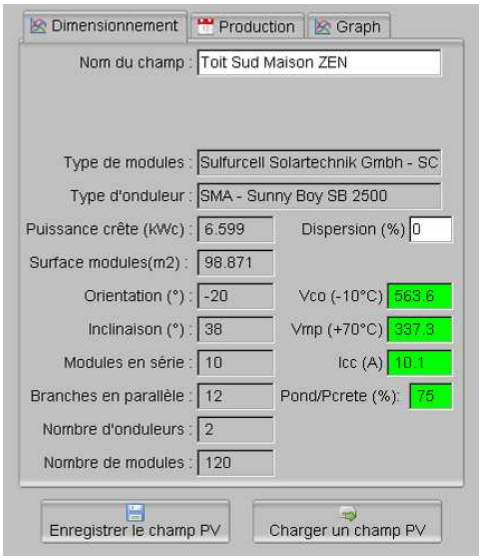
- roof dimensions,
- PV field dimensions,
- positioning of modules,
- wiring and spacing between modules (positive or negative to take into account overlapping).

In off-grid mode, it is possible to choose a battery type and regulator; the tab inverter only appears if the output current is alternative.

The field can be saved.

The monthly production of each field is displayed at the tab production and it is possible to see the hourly power curve for each average day of the month at the tab “Graph”.





A summary of the main characteristics of the field displayed at the tab « basic data". Voltage and current of the field are given. Depending on the inverter choice, the boxes are red or green. It is green if the voltage and the current match with the characteristics of the inverter. If not, the box is red. The ratio inverter power/power peak of the field is displayed, the box being green if this ratio comprises between 0.7 and 1.

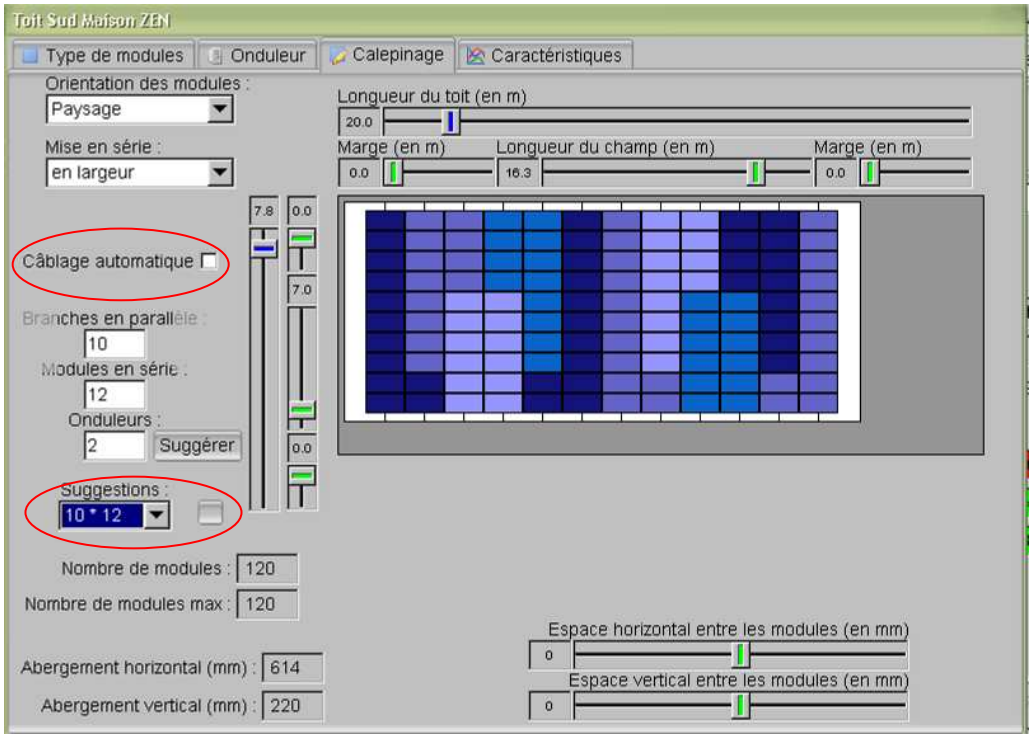
It is possible for the user to fill as many fields as he wants and to compare their monthly and hourly production (for March, June and December) by clicking on "Results graph".

PRO Manual string sizing:

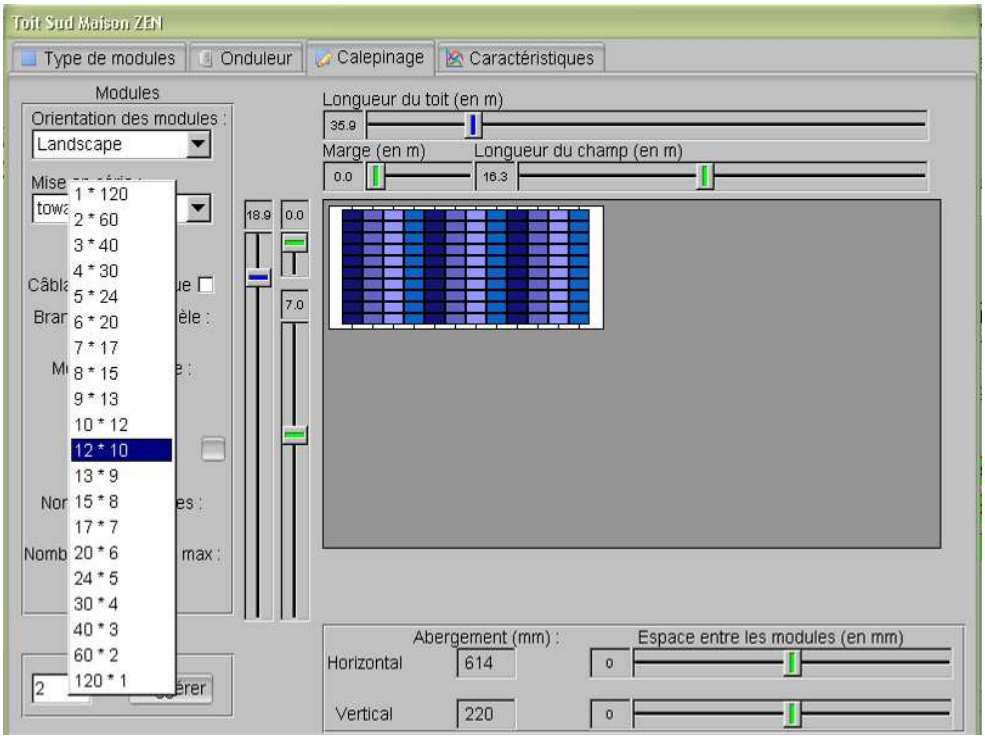
The manual mode is available by unselecting the "Automatic wiring" check box. Within this mode you can :

[6] Attention, pour quelques pas particuliers (façade, modules dont l'orientation s'éloigne fortement de 0°), un dimensionnement sortant des limites fixées par le logiciel pourra malgré tout être correct.

- Visualize the strings
- Select a modules/strings configuration
- Compute and select valid string configurations



- Calepinage 10.03
- Sizing function

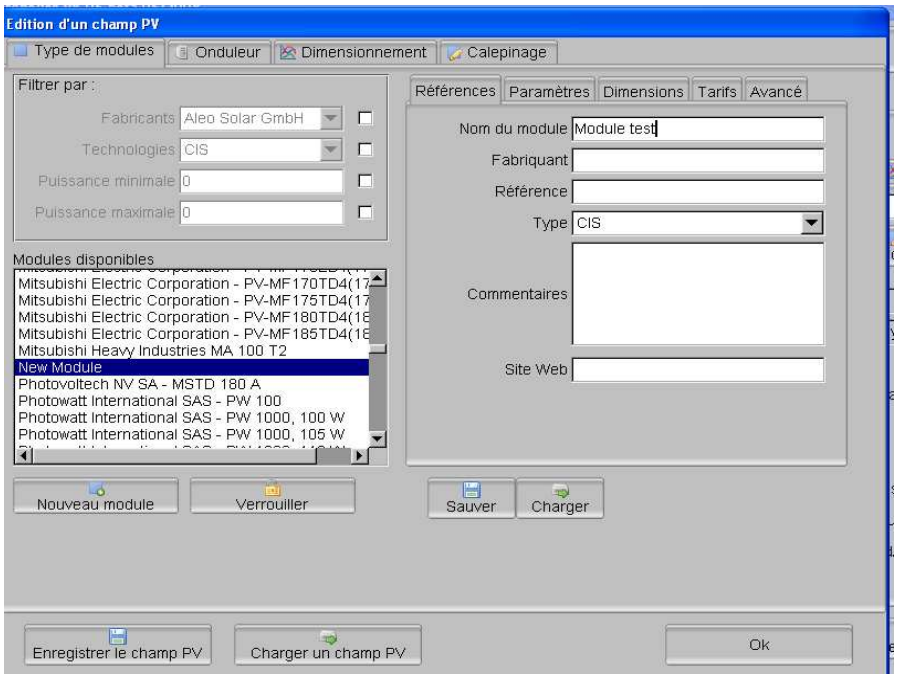


List of possible wiring configurations

List of valid wiring configurations

2.9.2 PV module edition

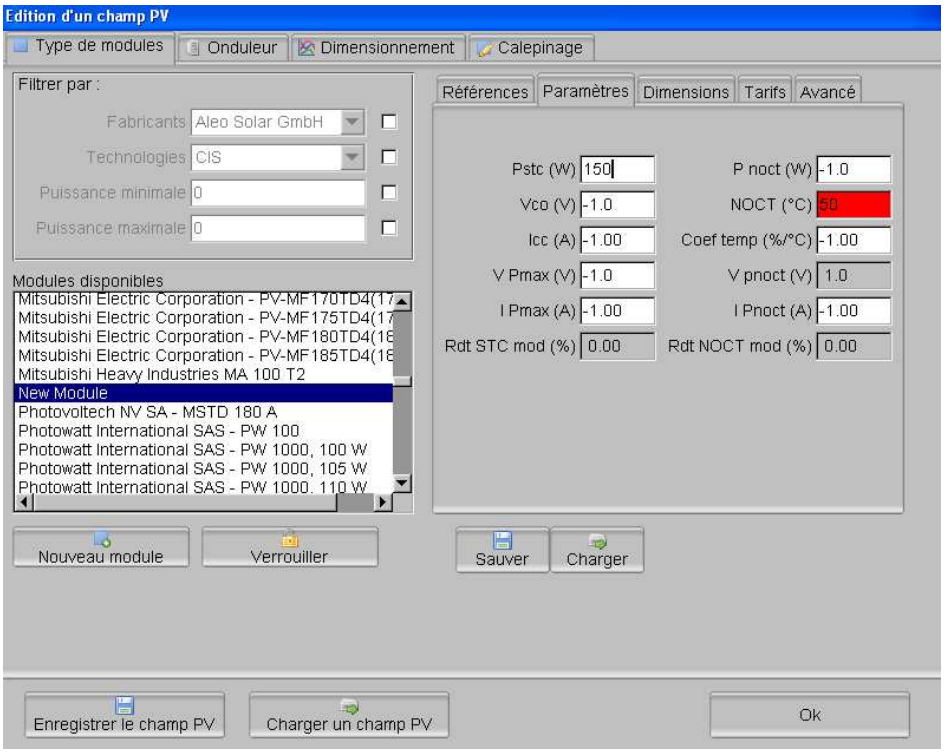
Click on “New module” then on ”Unlock”



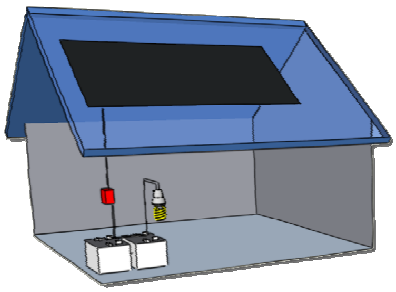
.

After having filled the modules references, the user can fill the electrical caracteristics of the module at the tab « Parameters ».

[7] Seuls les caractéristiques STC et le coefficient de température sont essentiels au calcul pour le connecté réseau. La NOCT est fixée par défaut à 50°C.

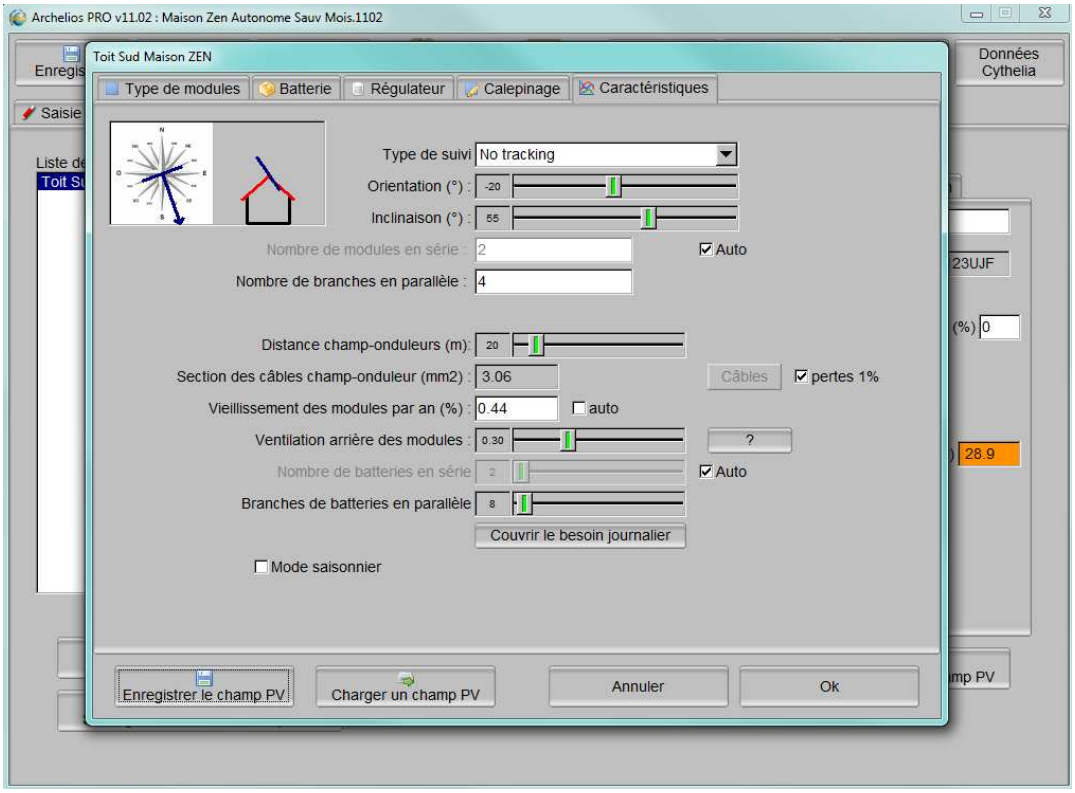


2.9.3 Autonomous systems



Depending on the choice made in the settings (mode autonomous, AC or DC), the inverters, batteries and regulators tabs appear or not. The choice of material here is similar.

The sizing tab is changed. If the chosen output current is continuous, the number of modules in series shall be fixed by default (box "Auto" checked by default). The same is for the number of the batteries. This number is calculated automatically from voltage Branch DC NOCT.



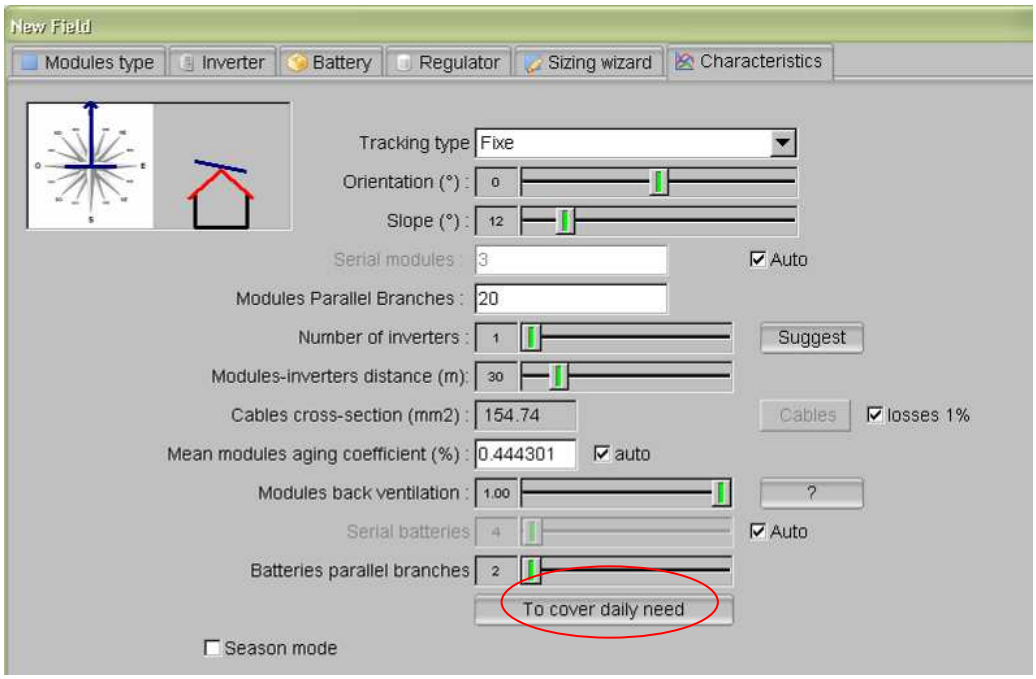
The button "Suggest" allows you to determine the number of batteries according to the number of parallel branches modules (if "Auto" is unchecked, the number of batteries will also be computed.

New 11.02: A new "**Cover daily needs**" functionality has been added:

Based on the hourly needs profiles and hourly production estimation, the

buttons allows to compute/size the necessary numbers of batteries and modules.

- The number of modules is set to cover the maximum daily deficit (production – needs)
- The number of batteries modules is set to cover the needs during the number of days(defined in parameters tab)



To go back to old sizing mode (season needs cover) check the “Season mode” box:

Archelios provides three optimization functions for standalone installations:

"Branches Vs Productible" is used to calculate the number of parallel branches needed to cover the needs

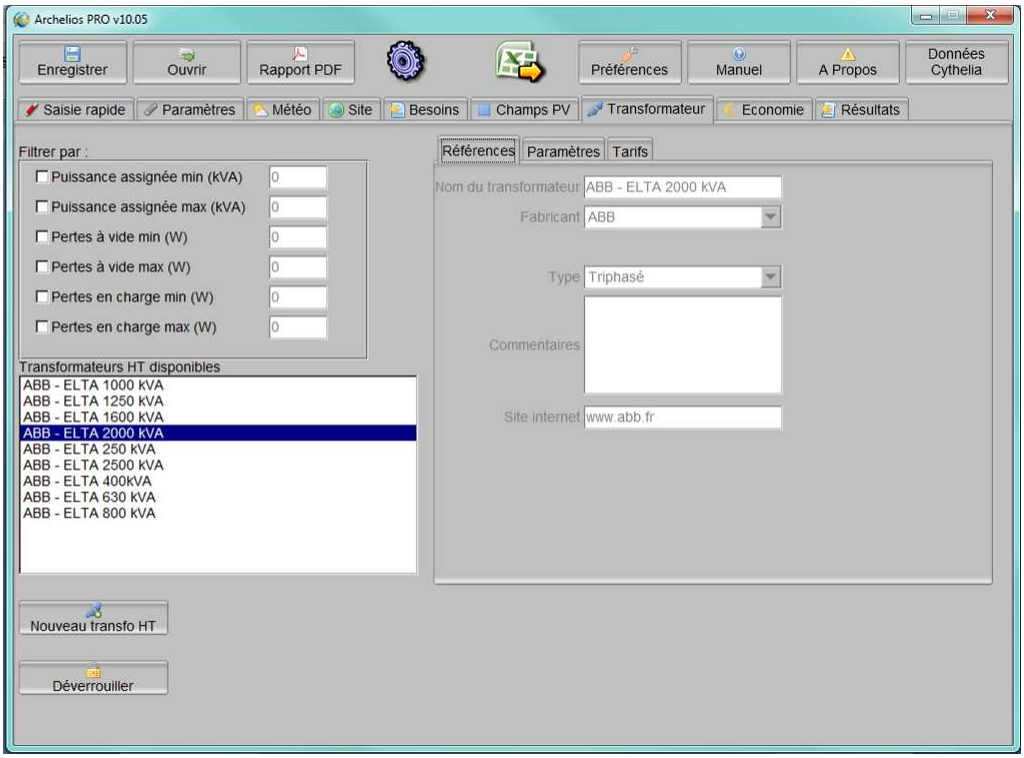
"Optimize versus winter deficit» calculates the ideal inclination to minimize the winter deficit.

"Minimize the cost" allows lowering the cost of the system by increasing the number of branches in parallel (and thus reducing the number of batteries more expensive than modules).

2.10 Transformer tab

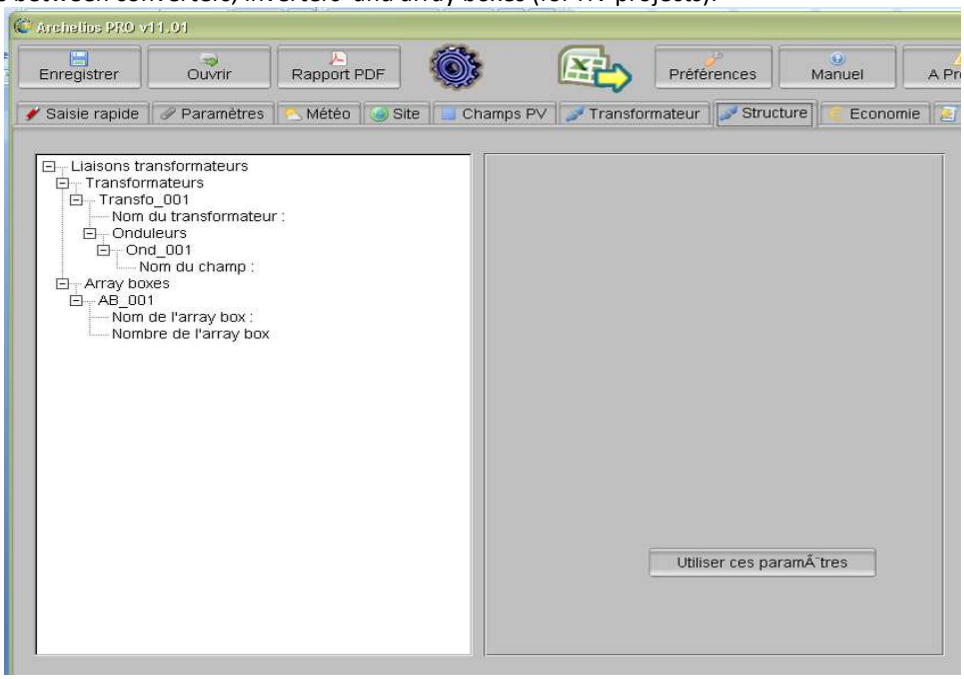
This tab is visible only when he High Voltage mode is activated. The tension converter choice is similar to the one of a module.

HVConverter looses are calculated and are considered in tab “Results”.



2.11 Structure tab

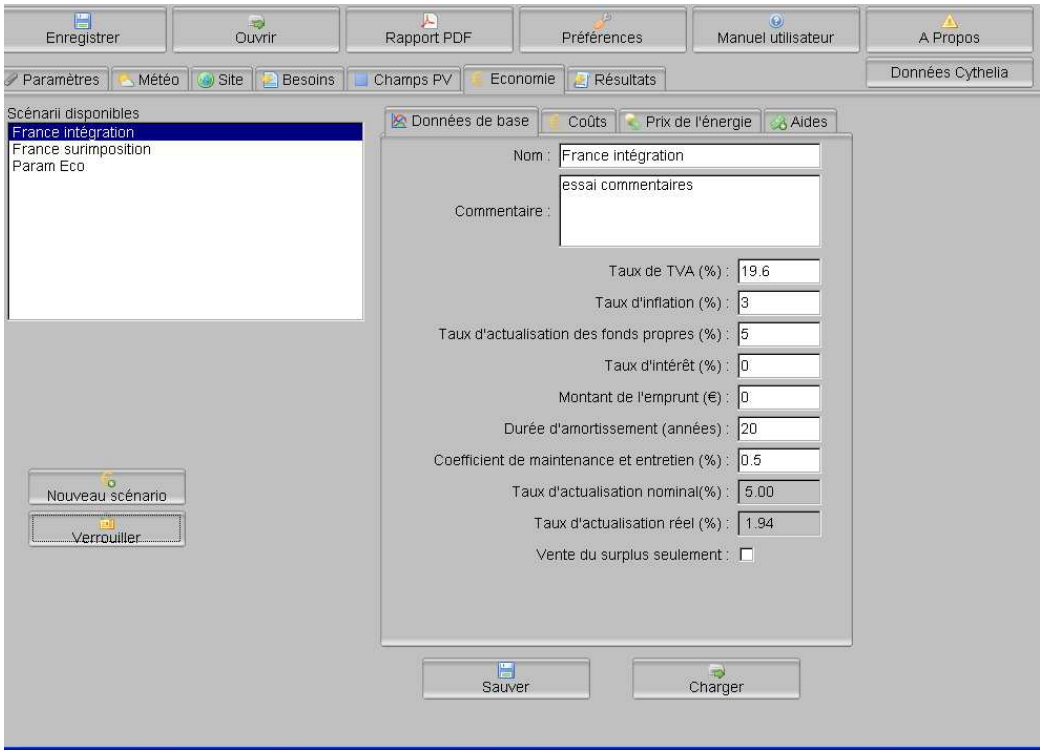
This tab is visible only when he High Voltage mode is activated in “parameters” tab. « Structure » tab is used to set the links between converters, inverters and array boxes (for HV projects):



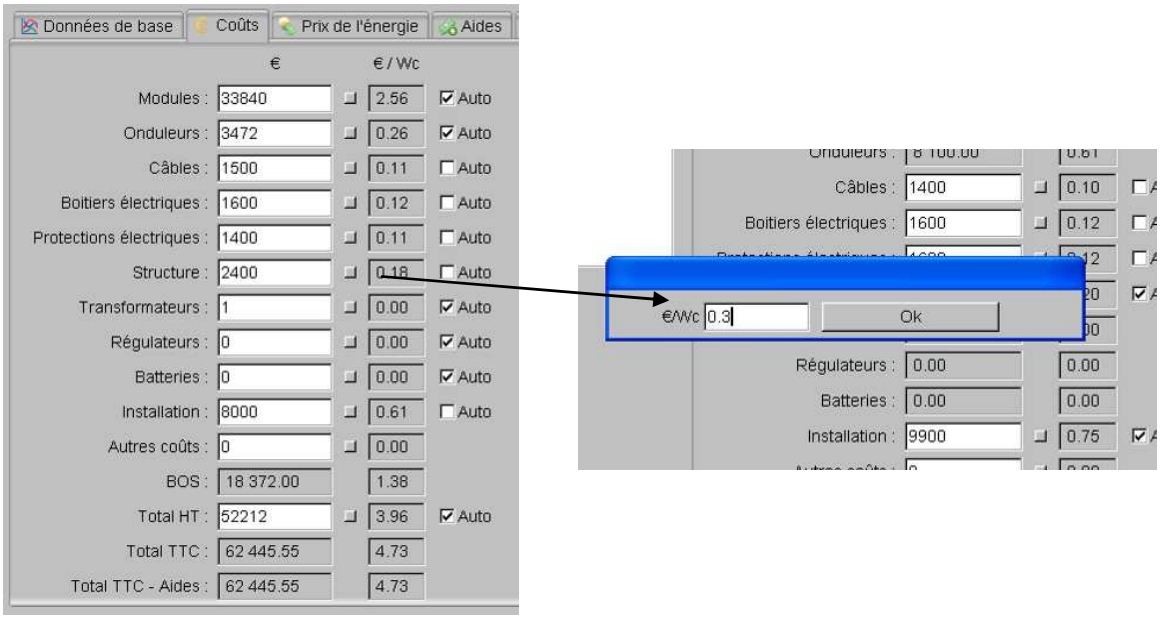
Array boxes/converters settings

2.12 Economic tab

The method of economic calculation ("method TEC") used was formalized by Bernard Chabot (ADEME)



The tab « Basic Data » allows filling the VAT rate, inflation, discount rate of shareholders equity, loan, depreciation period, operating and maintenance.


Données de base
Coûts
Prix de l'énergie
Aides
€
€ / Wc
Modules : 33840 2.56 Auto
Onduleurs : 3472 0.26 Auto
Câbles : 1500 0.11 Auto
Boitiers électriques : 1600 0.12 Auto
Protections électriques : 1400 0.11 Auto
Structure : 2400 0.18 Auto
Transformateurs : 1 0.00 Auto
Régulateurs : 0 0.00 Auto
Batteries : 0 0.00 Auto
Installation : 8000 0.61 Auto
Autres coûts : 0 0.00
BOS : 18 372.00 1.38
Total HT : 52212 3.96 Auto
Total TTC : 62 445.55 4.73
Total TTC - Aides : 62 445.55 4.73
Câbles : 1400 0.10
Boitiers électriques : 1600 0.12
€/Wc 0.3
Ok
Régulateurs : 0.00 0.00
Batteries : 0.00 0.00
Installation : 9900 0.75

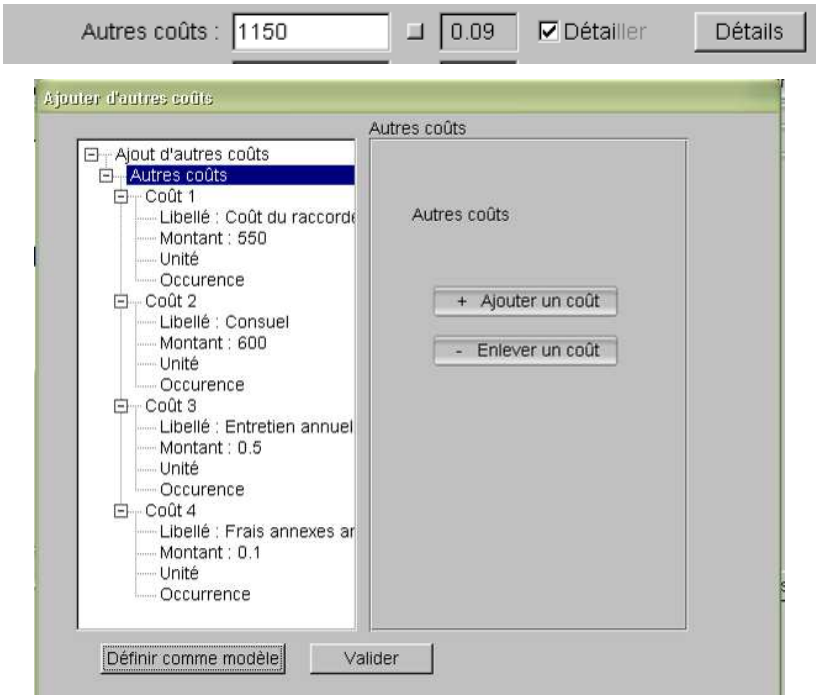
The tab « Costs » summarizes the different costs of the installation. The user can modify by un-checking the boxes “Auto”. Default values are displayed for cables, electric boxes and protections, structure and installation. A global cost can be set by un-checking the “Total net of tax” Auto box.

In the “Energy prices” section, the user can set the feed-in tariff as well as the purchasing price for grid electricity.

The user can also take into account the subsidies.

PRO Other costs:

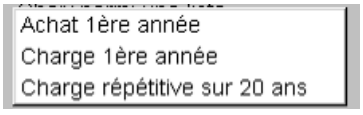
The "Details" button can be used to enter as many costs as necessary.



Other costs

The Input window allows you to:

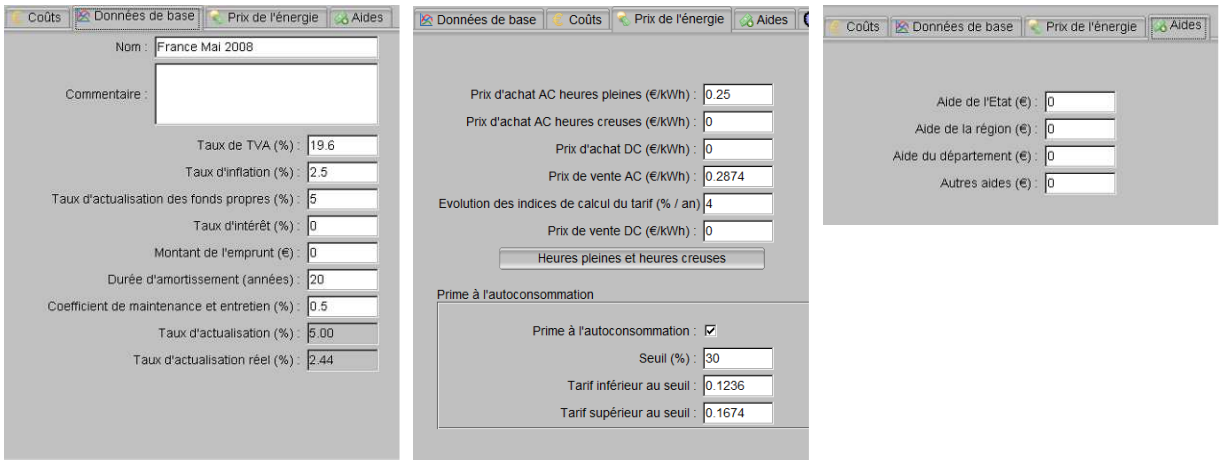
- Add, remove costs by selecting the "Other costs" node
- Change the cost label
- Enter the type of cost :

- To chose the occurrence: 

These costs are taken into account for the calculation of investment, revenues, and therefore economic results of the project.

Energy prices sub tab allows setting electricity tariffs (purchase and selling) and economics hypothesis (inflation rate, discount rate …).

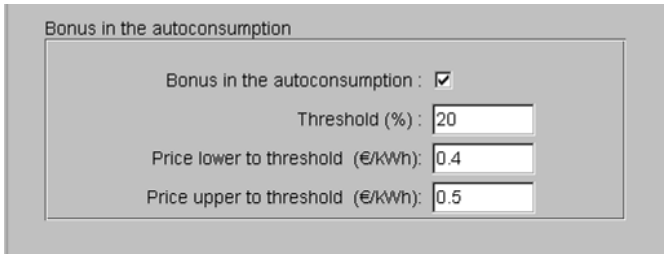
The « subsidies » tab allows setting region, local, national subsidies values.


Coûts
Données de base
Prix de l'énergie
Aides
Nom : France Mai 2008
Commentaire :
Taux de TVA (%) : 19.6
Taux d'inflation (%) : 2.5
Taux d'actualisation des fonds propres (%) : 5
Taux d'intérêt (%) : 0
Montant de l'emprunt (€) : 0
Durée d'amortissement (années) : 20
Coefficient de maintenance et entretien (%) : 0.5
Taux d'actualisation (%) : 5.00
Taux d'actualisation réel (%) : 2.44
Prix d'achat AC heures pleines (€/kWh) : 0.25
Prix d'achat AC heures creuses (€/kWh) : 0
Prix d'achat DC (€/kWh) : 0
Prix de vente AC (€/kWh) : 0.2874
Evolution des indices de calcul du tarif (% / an) 4
Prix de vente DC (€/kWh) : 0
Heures pleines et heures creuses
Prime à l'autoconsommation
Prime à l'autoconsommation :
Seuil (%) : 30
Tarif inférieur au seuil : 0.1236
Tarif supérieur au seuil : 0.1674
Aide de l'Etat (€) : 0
Aide de la région (€) : 0
Aide du département (€) : 0
Autres aides (€) : 0

« Economy » sub tabs

New 11.02 : new « Auto consumption » option in « energy prices » tab.

This new option allows simulating the economic scenarios where the energy consumed by the installation is favoured by the network manager or the State. This is the case for example in Germany.


Bonus in the autoconsumption
Bonus in the autoconsumption :
Threshold (%) : 20
Price lower to threshold (€/kWh): 0.4
Price upper to threshold (€/kWh): 0.5

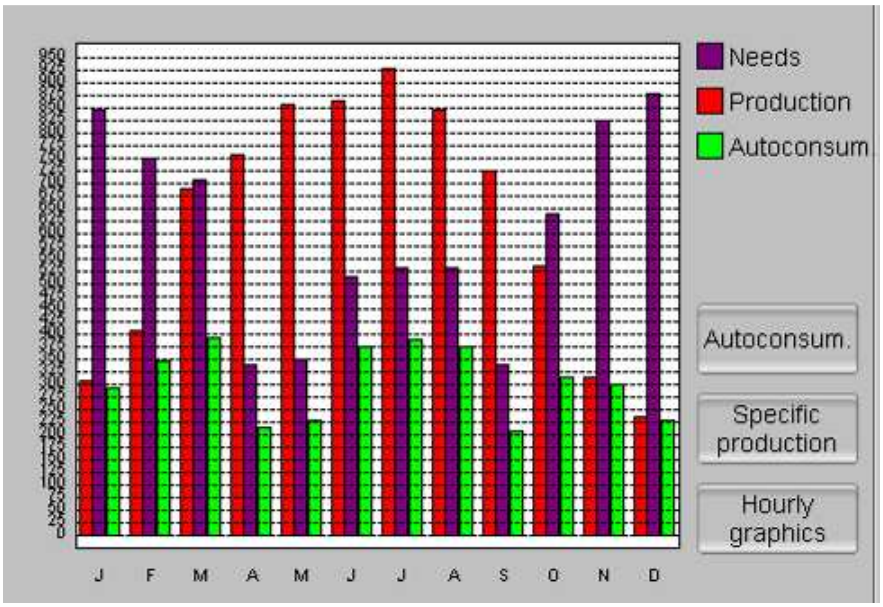
Auto consumption bonus

The auto consumption bonus is divided in two parts:

- auto consumed energy bellow a threshold (% of annual consumed energy / annual production)
- auto consumed energy above this threshold

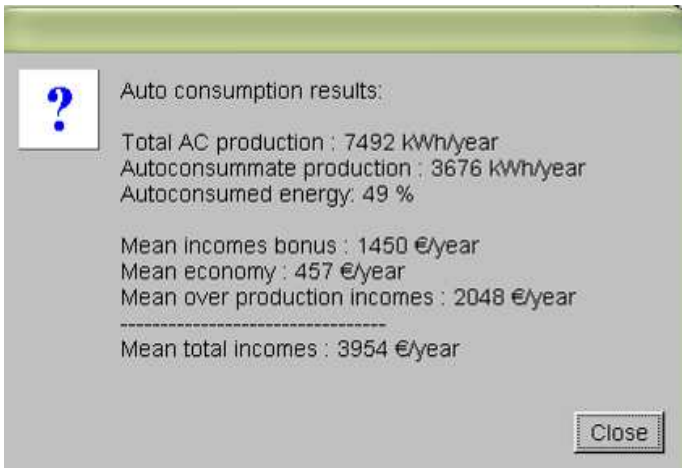
Reminder: the needs profiles are set in the Needs tab, for each hour of each month.

When Bonus for auto consumption option is checked, values of production and consumption are calculated and compared hour by hour during the simulation and the results are displayed in the "Results" tab as well as in the PDF report.

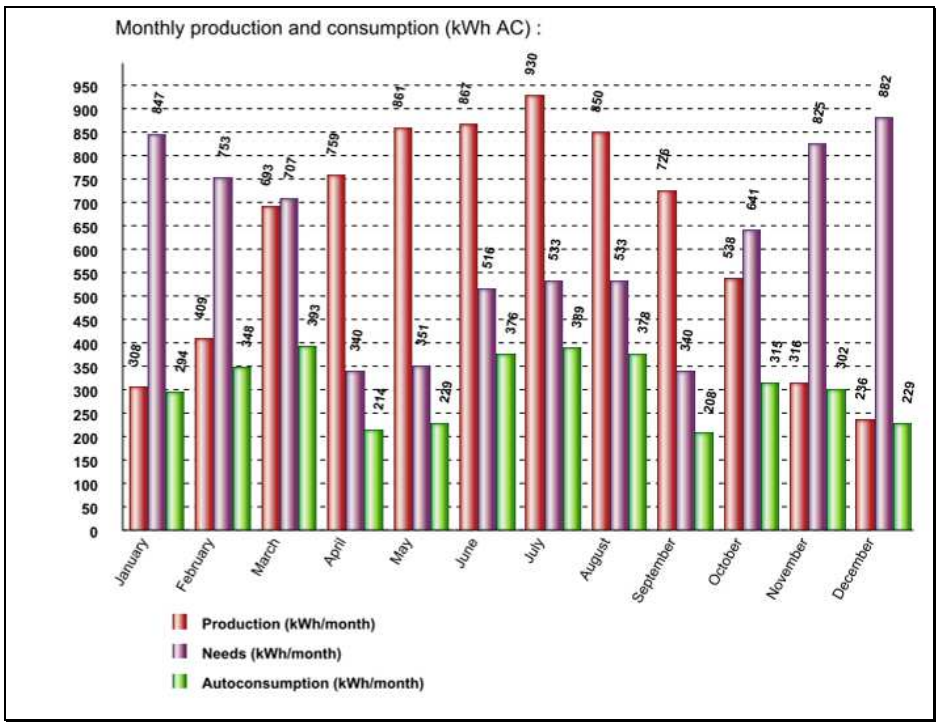


Auto consumption monthly results

Auto consumption hourly results


Auto consumption results:
Total AC production : 7492 kWh/year
Autoconsummate production : 3676 kWh/year
Autoconsumed energy: 49 %
Mean incomes bonus : 1450 €/year
Mean economy : 457 €/year
Mean over production incomes : 2048 €/year
Mean total incomes : 3954 €/year
Close

Economics results



Results in PDF report

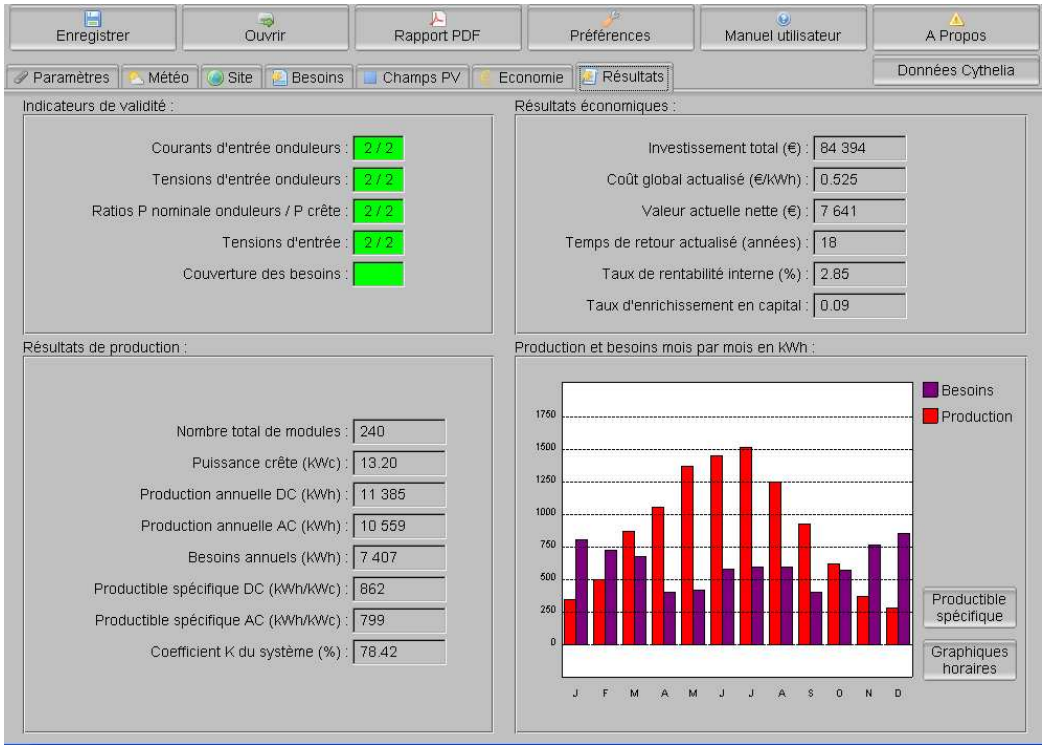
2.13 Results tab

The main results of the study are summarized in this tab.

The profitability indicators are:

- Overall Discounted Cost which set the price of the kWh produced
- Net Present Value : these are the earnings at the end of the observation period
- Discounted Payback period
- Internal Rate of Return : profitability of the investment

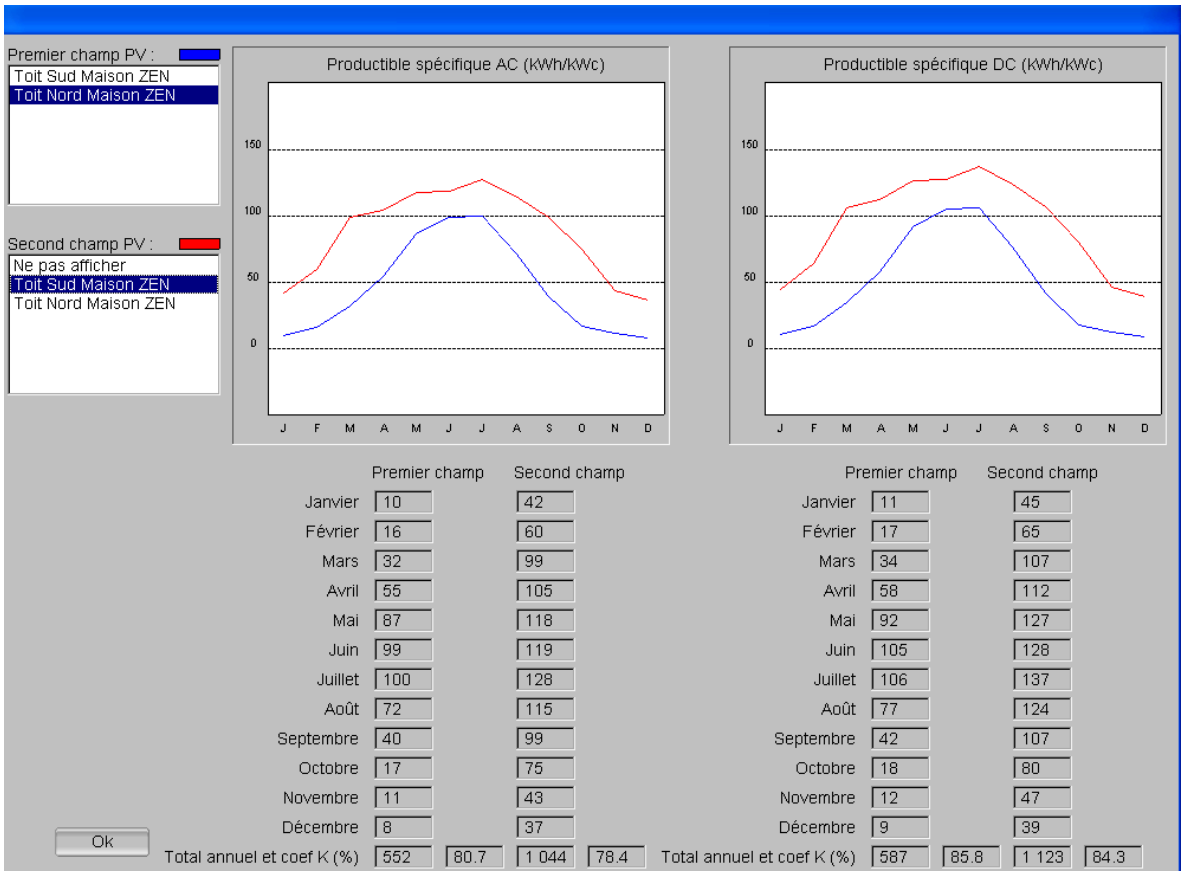
- Profitability index: This has to be greater than 30%.



The production outcomes of the system are given in AC and DC.

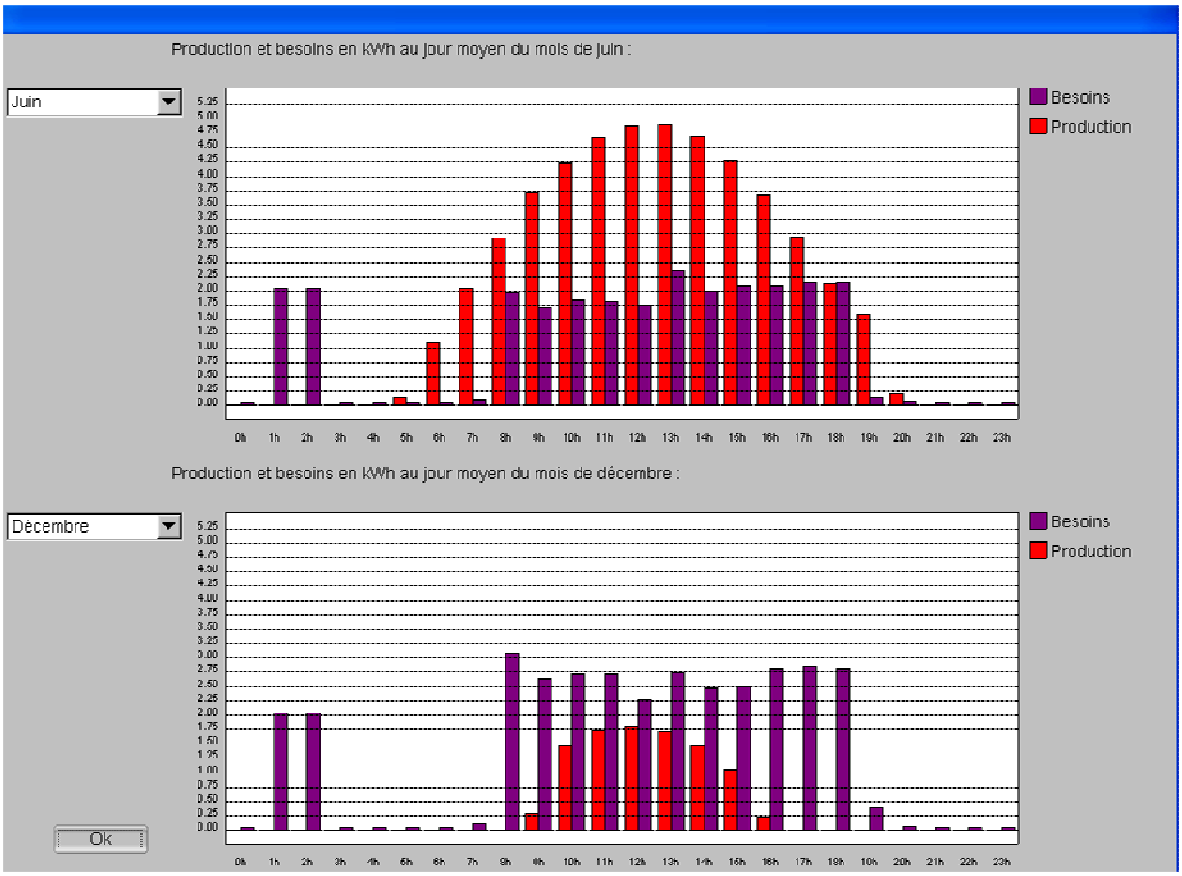
One can see the production and needs on a graph.

On the right, two buttons enables to access the specific production and hourly productions.



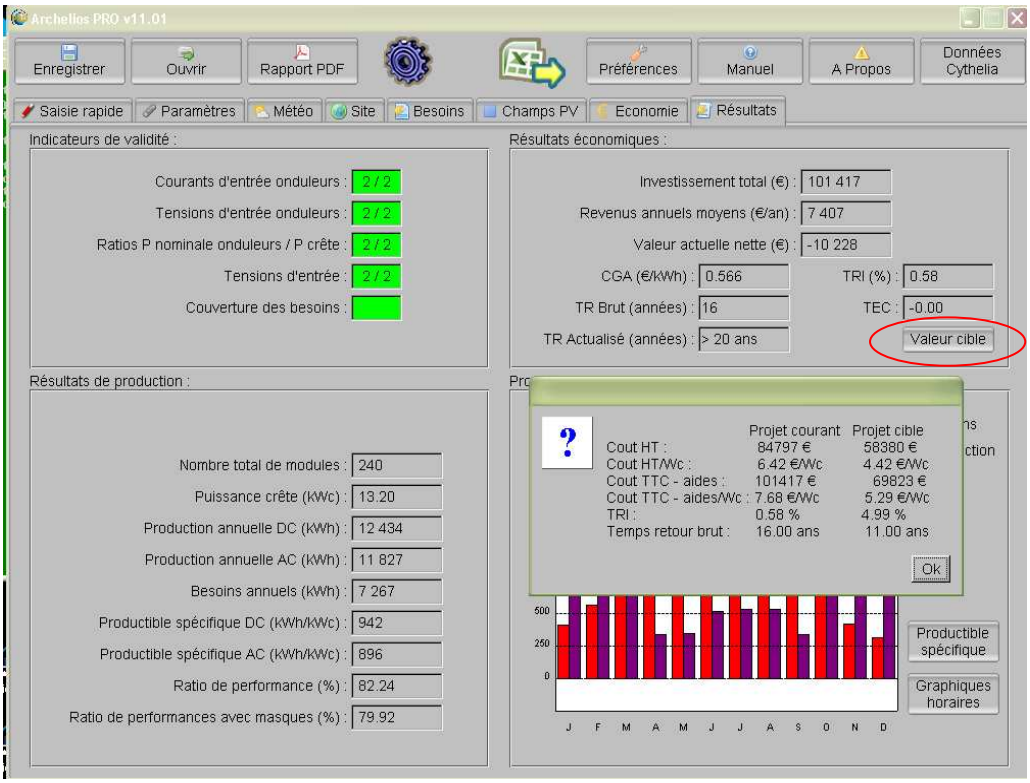
The specific production (in kWh/kWp) is given monthly for two chosen fields. The annual coefficient performance is also given.

[8] Ce coefficient permet de juger de la performance d'un système sans tenir compte de l'ensoleillement. C'est le ratio entre le productible spécifique et l'irradiation annuelle reçue par les capteurs.



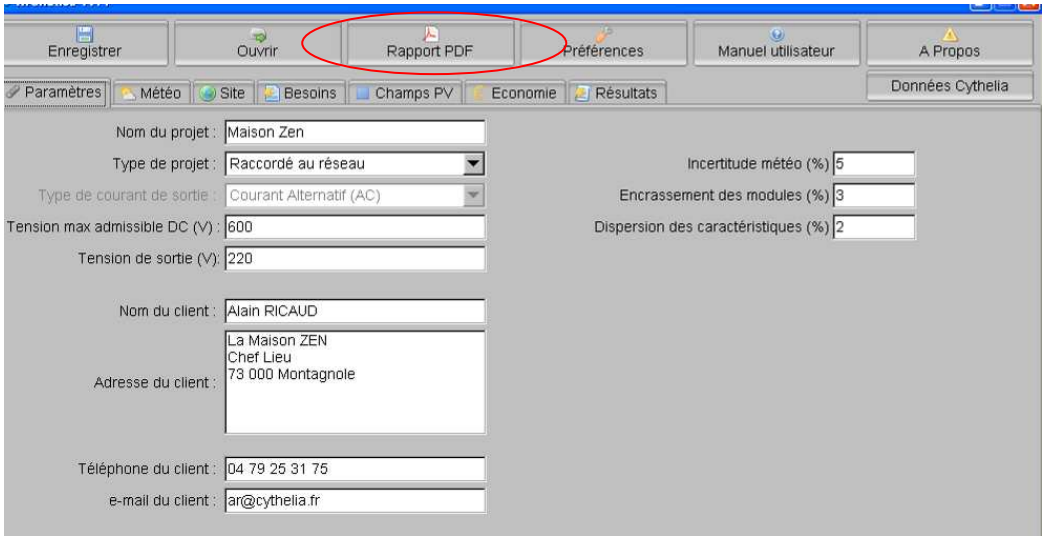
Hourly results

« Goal seek » functionality : « if I want a time of return of 12 years, how much do I have to sell the installation ? » …


Archelios PRO v11.01
Enregistrer
Ouvrir
Rapport PDF
Préférences
Manuel
A Propos
Données Cythelia
Saisie rapide
Paramètres
Météo
Site
Besoins
Champs PV
Economie
Résultats
Indicateurs de validité :
Courants d'entrée onduleurs : 2 / 2
Tensions d'entrée onduleurs : 2 / 2
Ratios P nominale onduleurs / P crête : 2 / 2
Tensions d'entrée : 2 / 2
Couverture des besoins :
Résultats économiques :
Investissement total (€) : 101 417
Revenus annuels moyens (€/an) : 7 407
Valeur actuelle nette (€) : -10 228
CGA (€/kWh) : 0.566
TRI (%) : 0.58
TR Brut (années) : 16
TEC : -0.00
TR Actualisé (années) : > 20 ans
Valeur cible
Résultats de production :
Nombre total de modules : 240
Puissance crête (kWc) : 13.20
Production annuelle DC (kWh) : 12 434
Production annuelle AC (kWh) : 11 827
Besoins annuels (kWh) : 7 267
Productible spécifique DC (kWh/kWc) : 942
Productible spécifique AC (kWh/kWc) : 896
Ratio de performance (%) : 82.24
Ratio de performances avec masques (%) : 79.92
Projet courant
Projet cible
Cout HT : 84797 € 58380 €
Cout HT/Wc : 6.42 €/Wc 4.42 €/Wc
Cout TTC - aides : 101417 € 69823 €
Cout TTC - aides/Wc : 7.68 €/Wc 5.29 €/Wc
TRI : 0.58 % 4.99 %
Temps retour brut : 16.00 ans 11.00 ans
Ok
Productible spécifique
Graphiques horaires

Goal seek functionality

2.14 Rapport PDF PDF file



The button « PDF report » enables to edit a report from the data of the project.

It includes site, meteo, masks, PV filed descriptions and economic results.

PRO If you have a PRO version you can export the contents of the pdf file to a csv file (compatible with excel) and define the content of the pdf file. For more information on this feature please refer to the "Cythelia Plug-in" section.

2.15 Settings button

The user can change the language as well as the diffuse irradiation model (Perez by default).

2.16 About

Partners and useful links are presented.

Archelios v9.08
A Propos d'Archelios
Credits
Cette version d'Archelios a été réalisée grace à la coopération de :
- Cythelia qui a piloté le projet, développé le logiciel initial et les algorithmes depuis 2001 et les a enrichis en permanence depuis cette date afin de les maintenir au niveau de l'état de l'art en la matière.
- Incub' qui a assuré la réalisation informatique du logiciel.
- Demotera qui a conçu la connexion entre Archelios et le serveur de bases de données Cythelia.
- l'Université de Savoie et l'ANR qui ont contribué au financement des travaux.
CYTHELIA
http://www.cythelia.fr
incub'
http://www.incub.net
AGENCE NATIONALE DE LA RECHERCHE
ANR
http://www.agence-nationale-recherche.fr
UNIVERSITE CHAMBERY ANNECY SAVOIE
http://www.univ-savoie.fr
Ok

2.17 Remarks

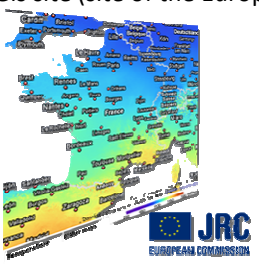
The production calculated is an average on the exploitation length (equal to the economic period) that takes into account the aging of the modules.

We recommend choosing 20 years for the observation period.

3. Archelios PRO functionalities

Since 10.03 version, the Archelios PRO contains additional features (plug-ins) to import and export data from/to Archelios.
Import possibilities are:

- Weather and distant mask data from the PVGis site (site of the European commission: http://re.jrc.ec.europa.eu/pvgis/index.htm)



- Google SketchUp files for near mask computation.

Google SketchUp

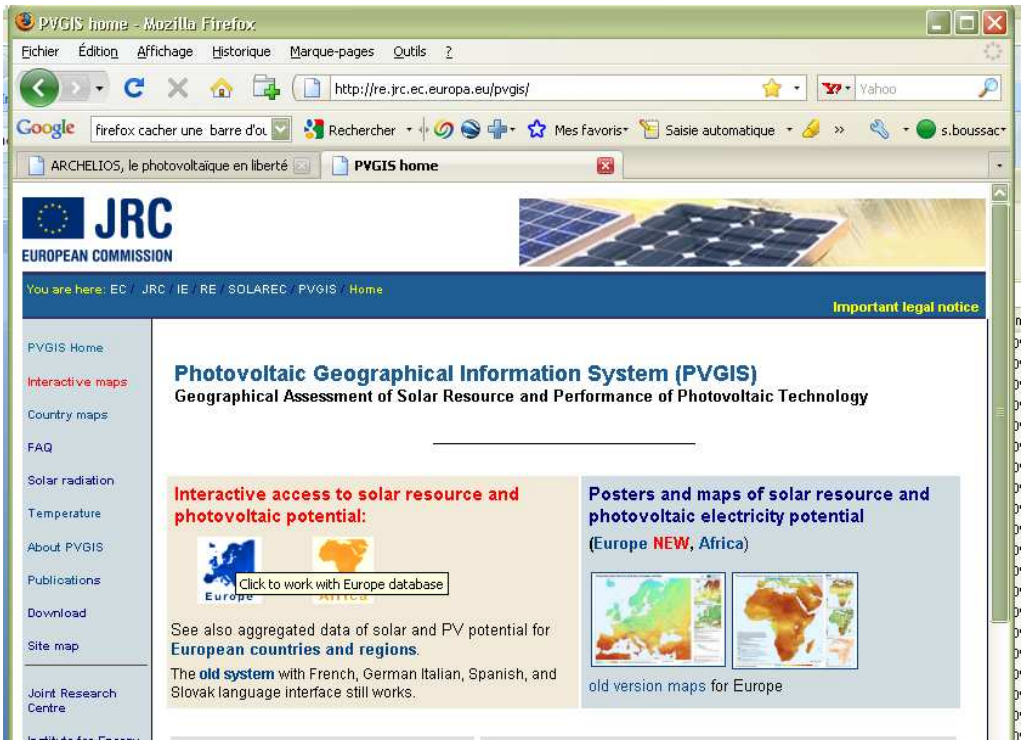
Different data and graphics are exportable to csv format, compatible with Microsoft ® Excel spreadsheets or open office.

OpenOffice

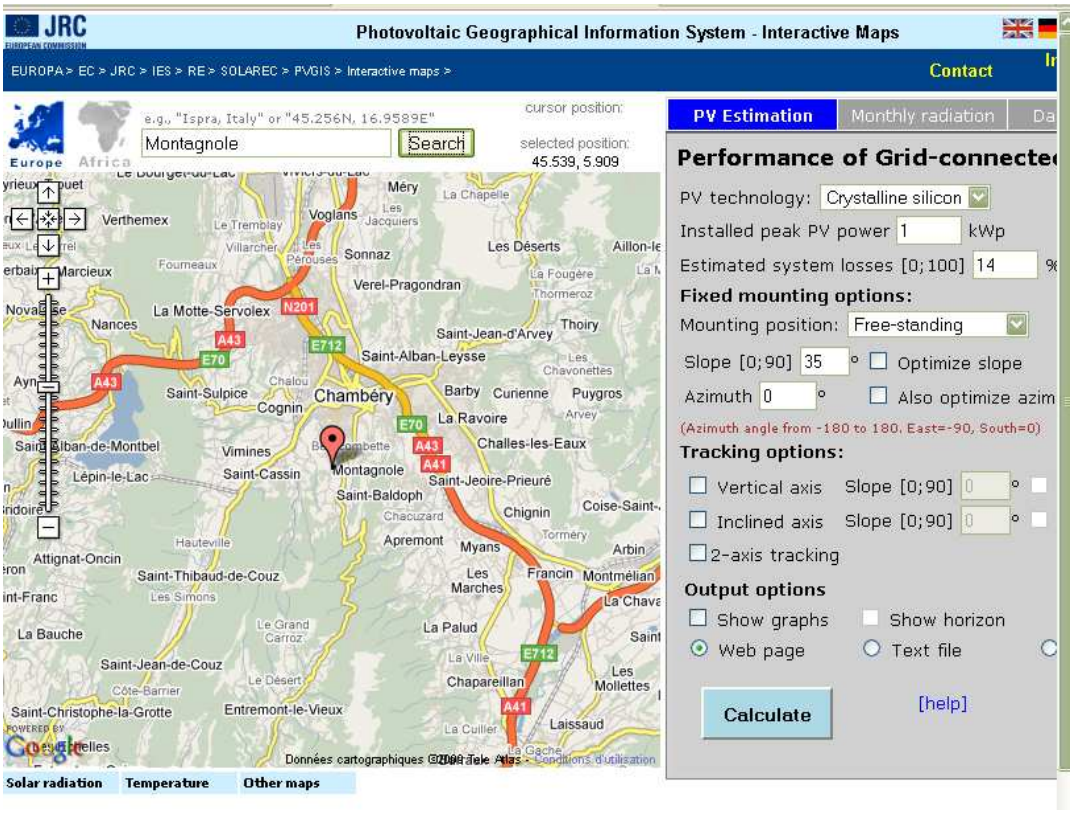
3.1 PRO *PVGis data importation*

The PVGis (weather and distant mask) data import procedure is as follows:
Go to website: http://re.jrc.ec.europa.eu/pvgis/

Depending of the location of your site click on the map Europe or Africa:

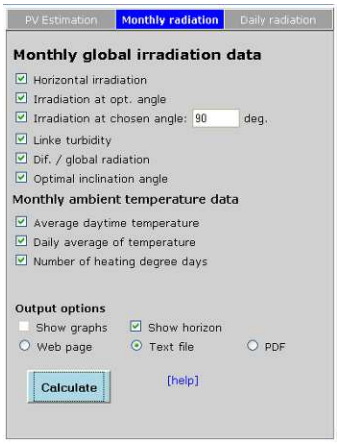

PVGIS home - Mozilla Firefox
JRC
EUROPEAN COMMISSION
PVGIS Home
Interactive maps
Country maps
FAQ
Solar radiation
Temperature
About PVGIS
Publications
Download
Site map
Photovoltaic Geographical Information System (PVGIS)
Geographical Assessment of Solar Resource and Performance of Photovoltaic Technology
Interactive access to solar resource and photovoltaic potential:
Click to work with Europe database
Posters and maps of solar resource and photovoltaic electricity potential
(Europe NEW, Africa)
See also aggregated data of solar and PV potential for European countries and regions.
The old system with French, German Italian, Spanish, and Slovak language interface still works.
old version maps for Europe

Then navigate on the map or enter the name of your site in the search bar:



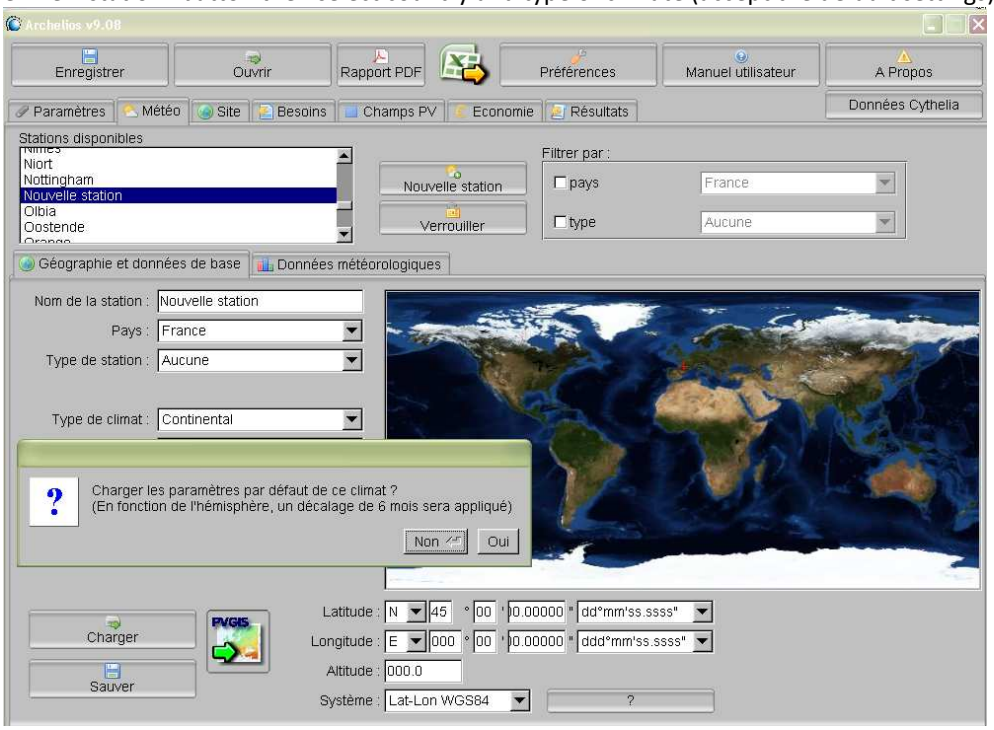
3.1.1 Meteorological data import

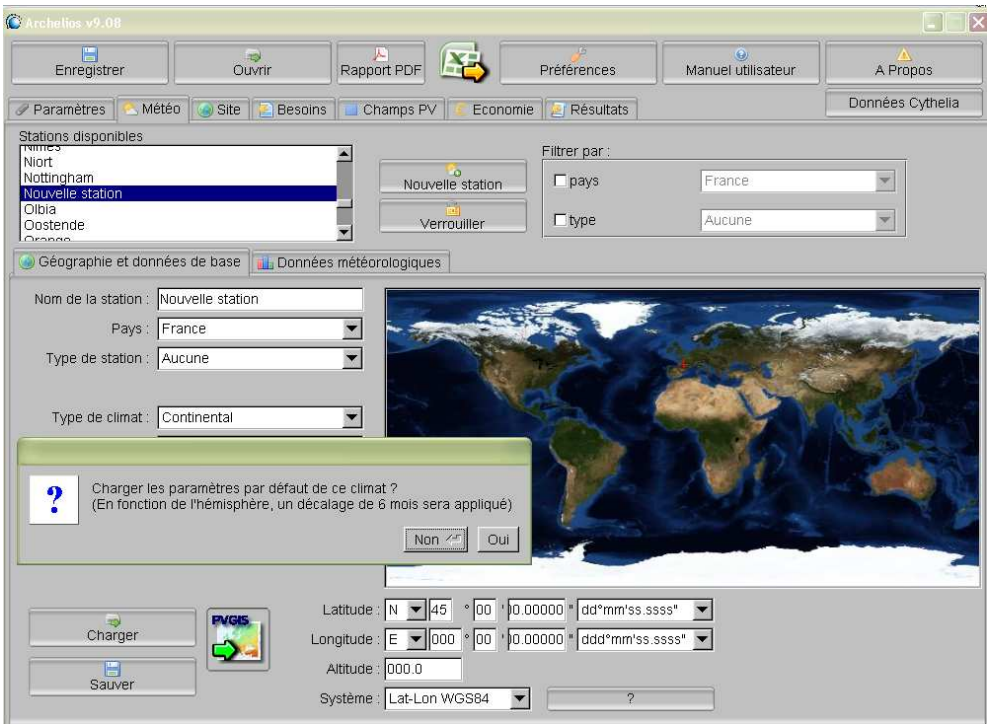
Click on « Monthly Radiation » tab :



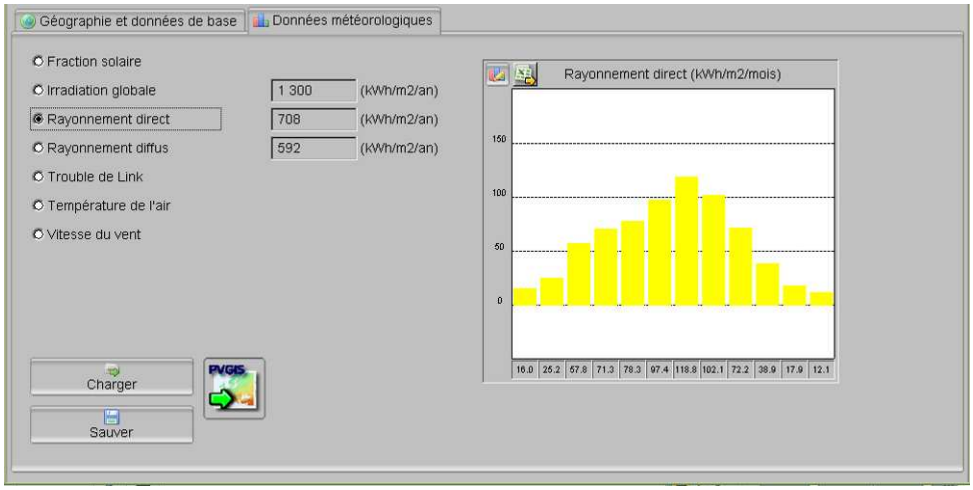
Check all data options and "Text file" , and then click "Calculate" button and save the file on your hard disk.

In the "Weather" tab of Archelios:
Click on the "New station" button then select country and type of climate (accept the default settings).





Click PVgis button and select the file on your hard drive. All data are imported into Archelios; you can check the values in the "Weather data" tabs.

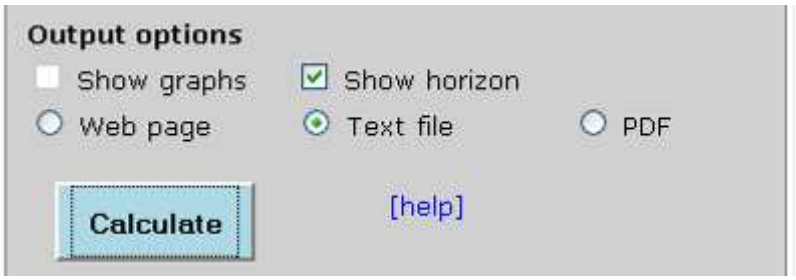


Use the button "Save" to save this new weather station on your workstation.

Note: you can only import weather data within the geographical location of your database (region, France, Europe...).

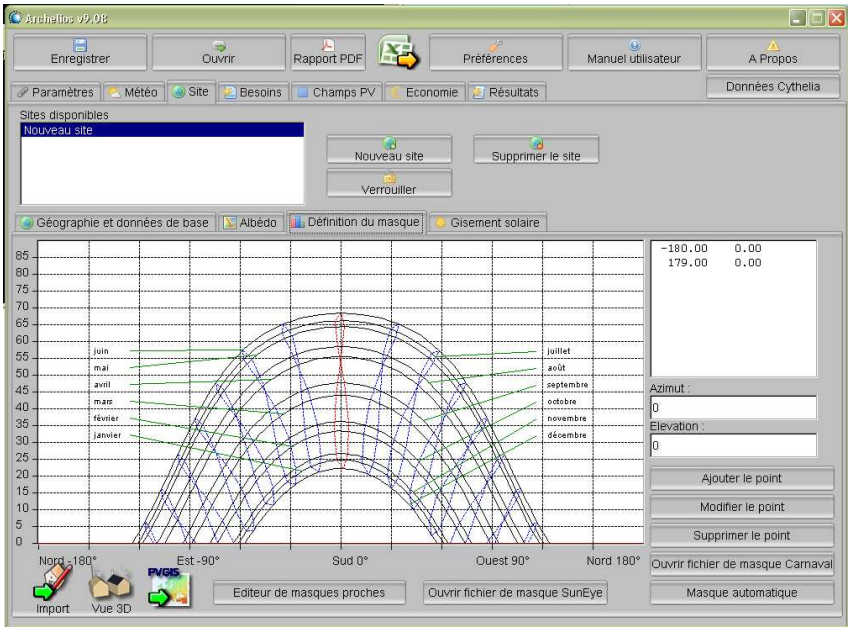
3.1.2 Mask data importation

Click on « PV Radiation » or « Daily radiation » tab :



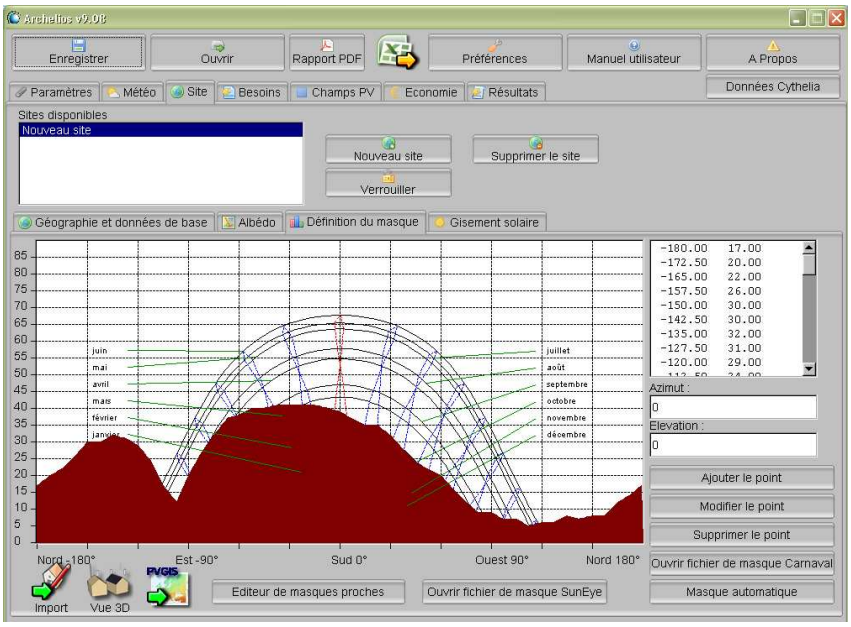
In the output options check options "Text file" and "Show horizon", click on the "Calculate" button and save the file on your hard disk.

In the "Site" tab of Archelios click “new site” and then click the "Mask definition:" tab



Click PVgis button and select the file on your hard drive.

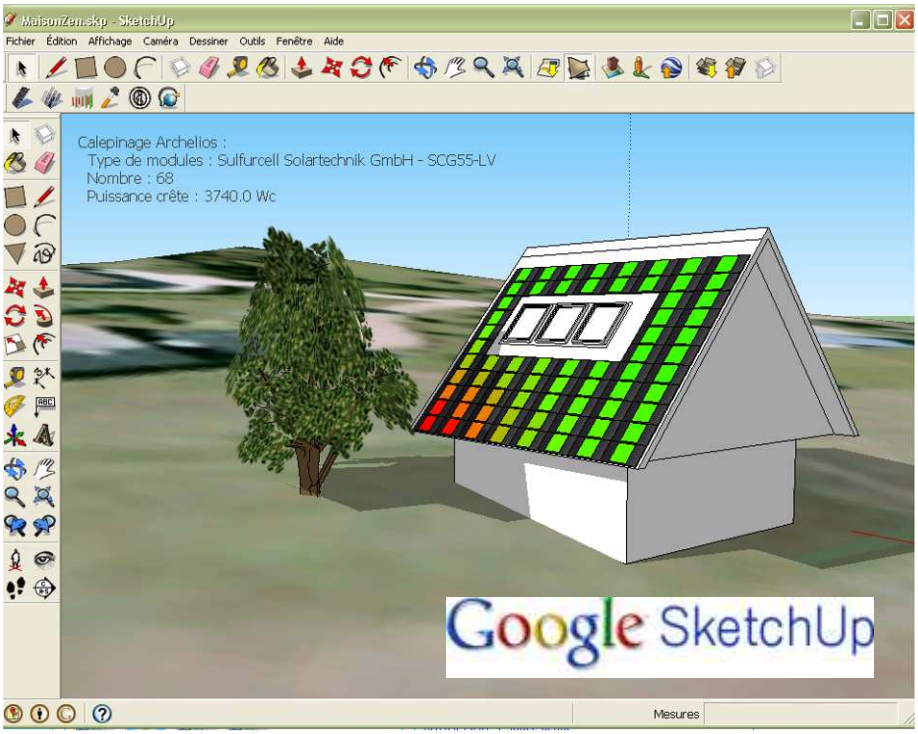
The entire mask data is imported into Archelios, as well as the coordinates of the site that you can accept or decline (in this case you will have to manually enter the coordinates of your site). Read mask is displayed in the interface, it will be saved in your project.



Note: the pattern given by PVgis is a distant mask, you can add a near mask to your project thanks to the near mask editor or import SunEye or Google SketchUp files (see section below).

3.2 PRO *Google SketchUp importation*

With Google SketchUp software you can define an accurate 3D model of buildings or objects with a few clicks. This model can be imported into Archelios and near mask is calculated automatically.


MaisonZen.skp - SketchUp
Fichier Édition Affichage Caméra Dessiner Outils Fenêtre Aide
Calepinage Archelios :
Type de modules : Sulfurcell Solartechnik GmbH - SCG55-LV
Nombre : 68
Puissance crête : 3740.0 Wc
Google SketchUp
Mesures

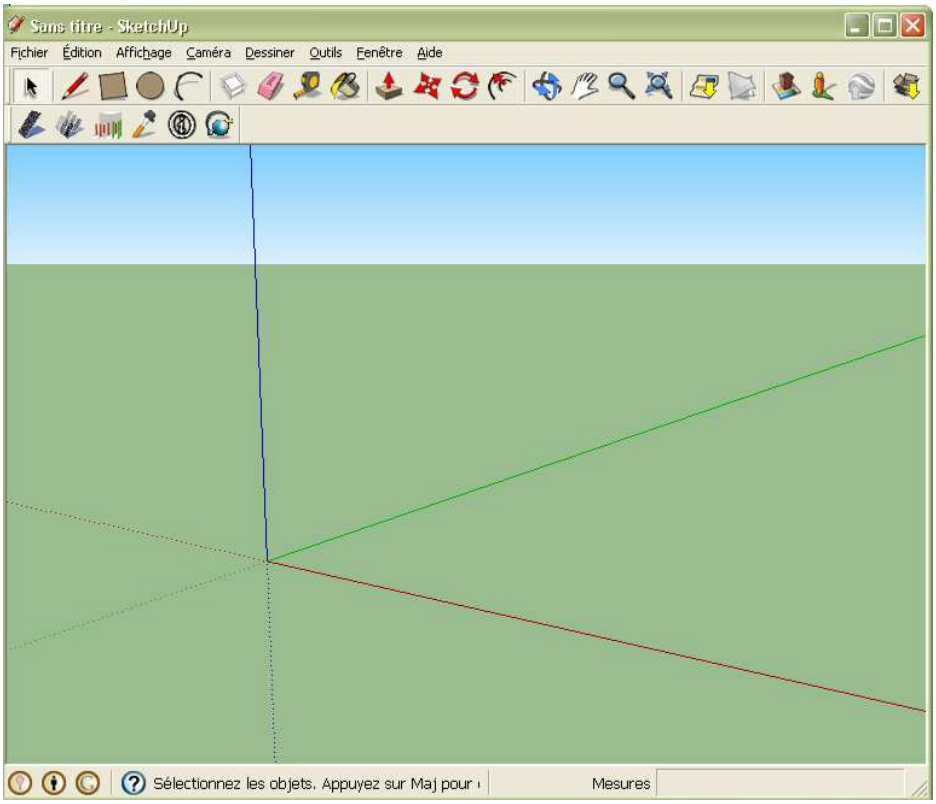
Modélisation 3D Google SketchUp avec simulation d'ombrage

Procedure for Google SketchUp files import:

The following software will be used in our example:

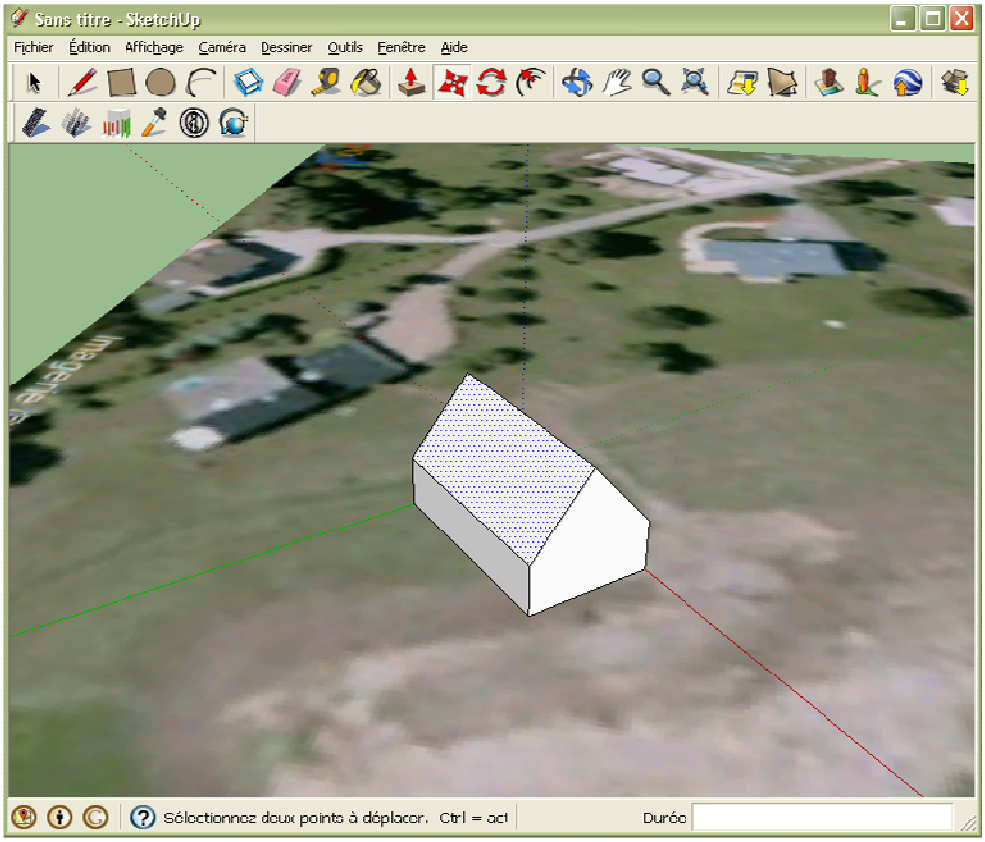
Google SketchUp 8 :
http://sketchup.google.com/intl/fr/

3.2.1 Site selection in Google SketchUp :


Sans titre - SketchUp
Fichier Édition Affichage Caméra Dessiner Outils Fenêtre Aide
Sélectionnez les objets. Appuyez sur Maj pour
Mesures

Ground image import in Google SketchUp

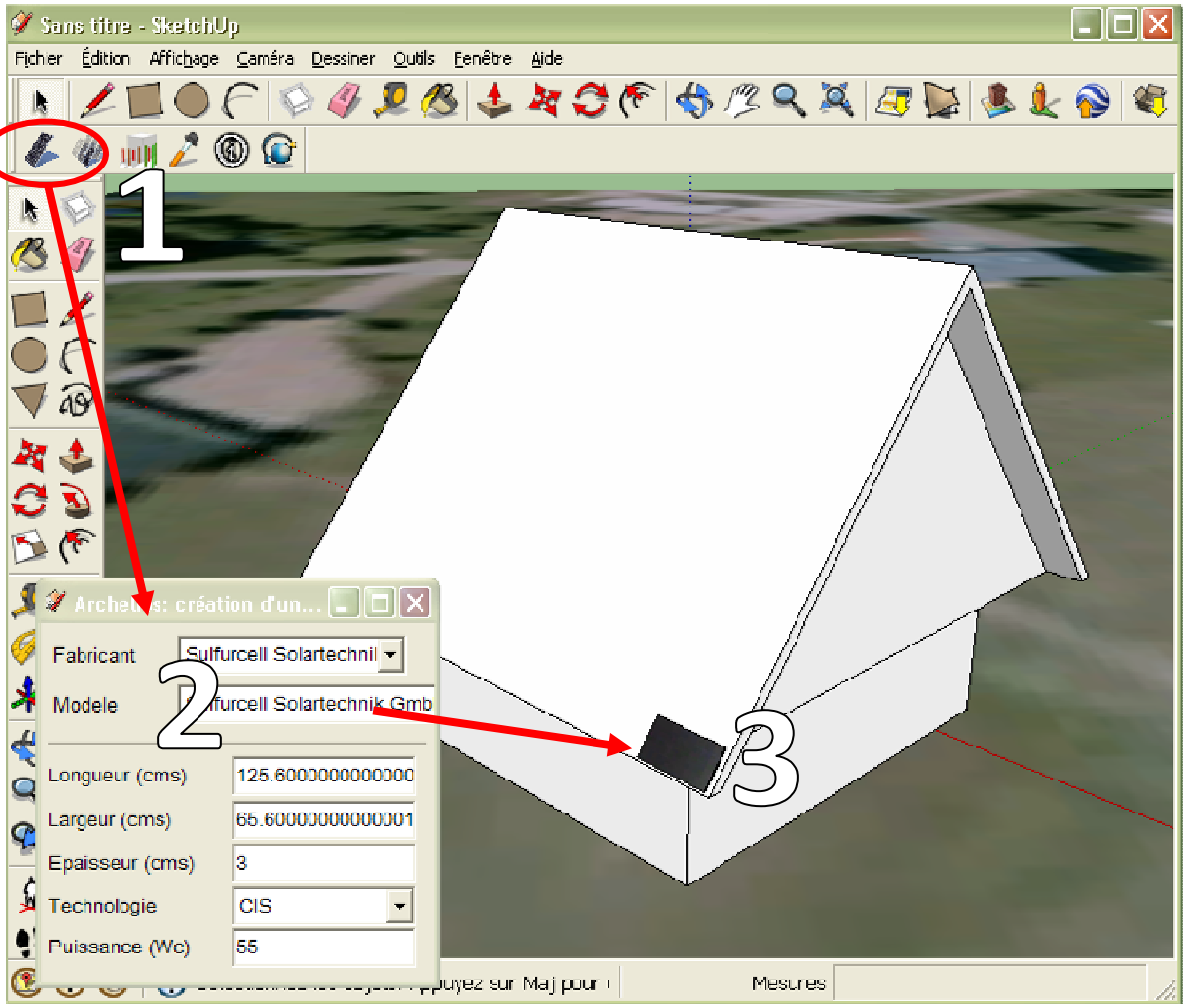
3.2.2 3D modeling (PV field and objects)


Sans titre - SketchUp
Fichier Édition Affichage Caméra Dessiner Outils Fenêtre Aide
Sélectionnez deux points à déplacer. Ctrl = act
Durée

3D model and definition of a « PV » texture on the photovoltaic field

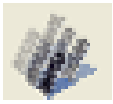
For tutorials about GoogleSketchup please refer to official site:
http://sketchup.google.com/intl/fr/community/resources.html

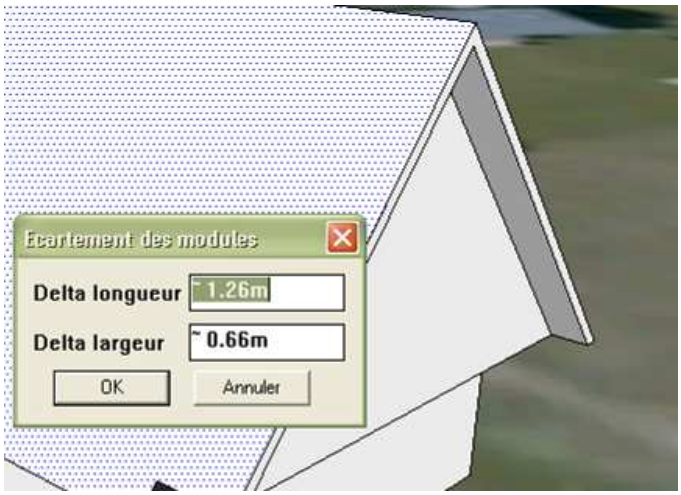
3D modeling in Google ketchup is done as usual.



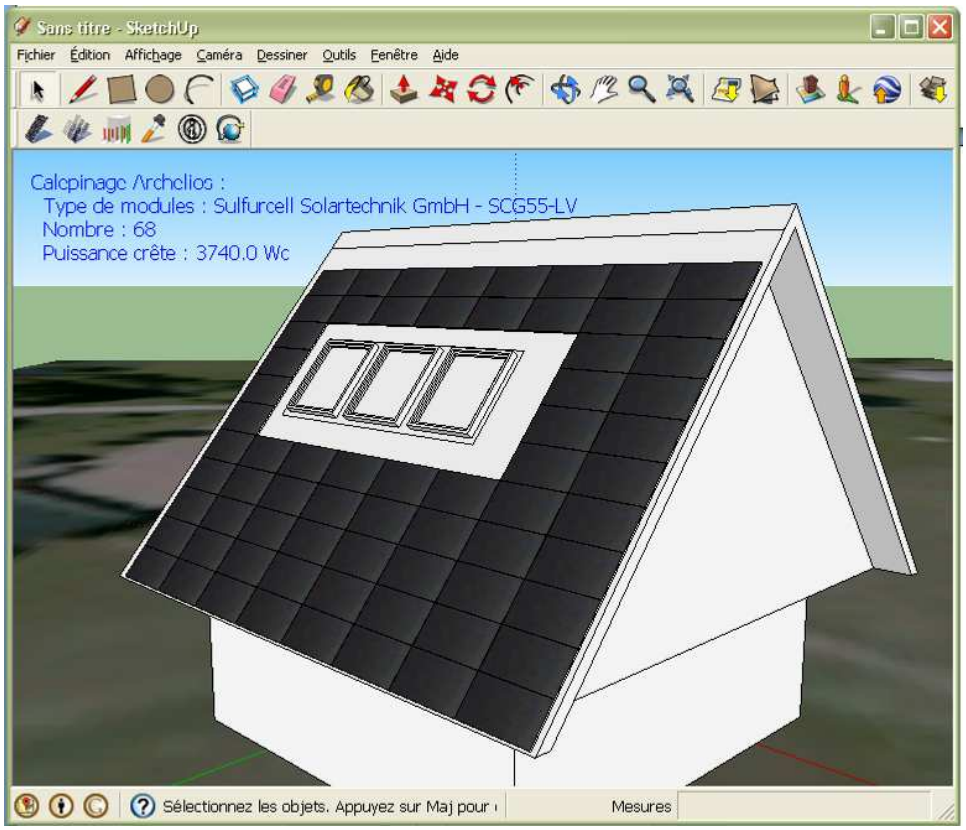
Insertion of PV modules

Adding PV modules is done in 4 steps:

1. Open modules database :
2. Select module
3. Place the first module on the roof (with the mouse)
4. Module duplication 
   a. The horizontal and vertical spacing can be set:



Module spacing


Sans titre - SketchUp
Fichier Édition Affichage Caméra Dessiner Outils Fenêtre Aide
Calepinage Archelios :
Type de modules : Sulfurcell Solartechnik GmbH - SCG55-LV
Nombre : 68
Puissance crête : 3740.0 Wc
Sélectionnez les objets. Appuyez sur Maj pour
Mesures

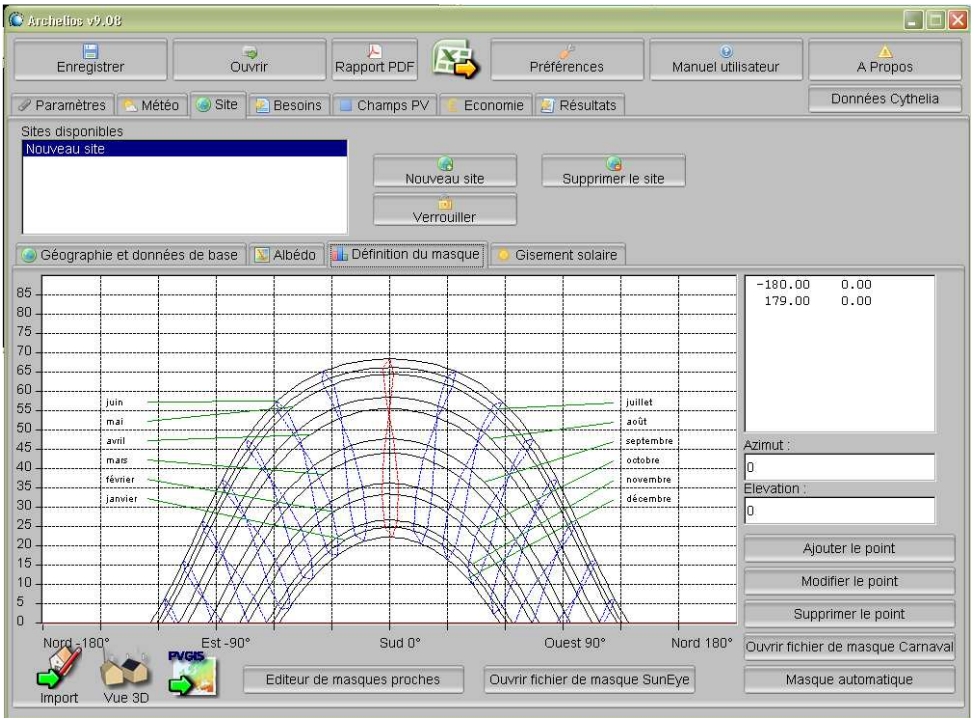
Automatic duplication

3.2.3 Save skp file on disk:

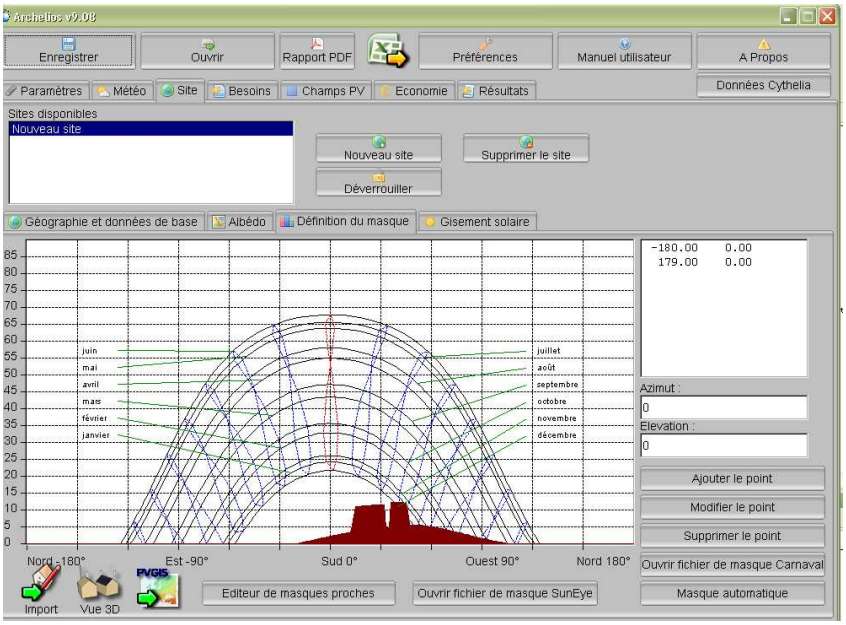
Use File Save or Save As function to create an « skp » file on your hard disk.

3.2.4 Import skp file in Archelios :

In « Site » tab , click on « New Site » and open « Mask Definition » tab :

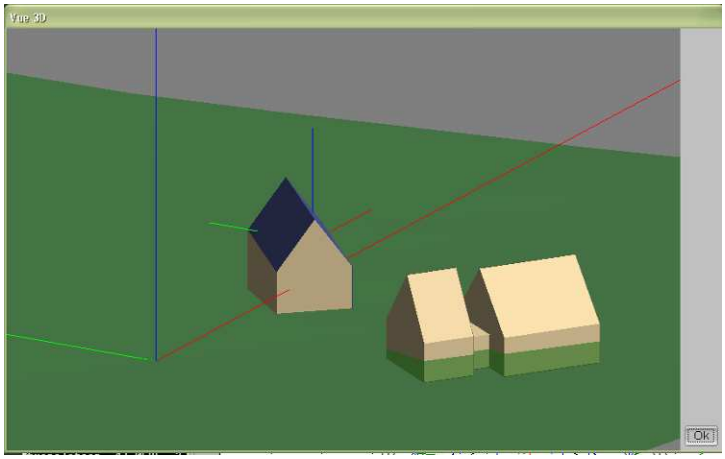


Click on the "Import" button and select the skp file. 3D data is imported into Archelios and mask is automatically computed. You can use coordinates of model as the localization of your site (if not don't forget to manually enter the coordinates of your site). Read mask is displayed in the interface, it will be saved in your project.

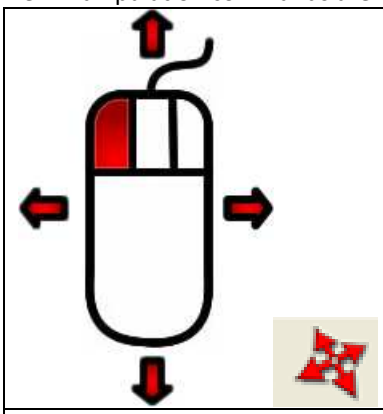
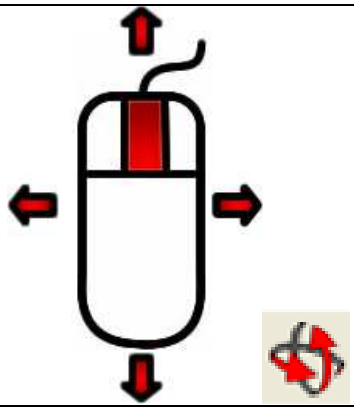
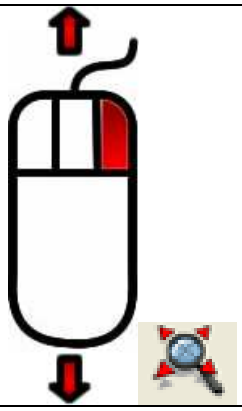


3.2.5 3D view

You can see a 2D or 3D view of the mask view.

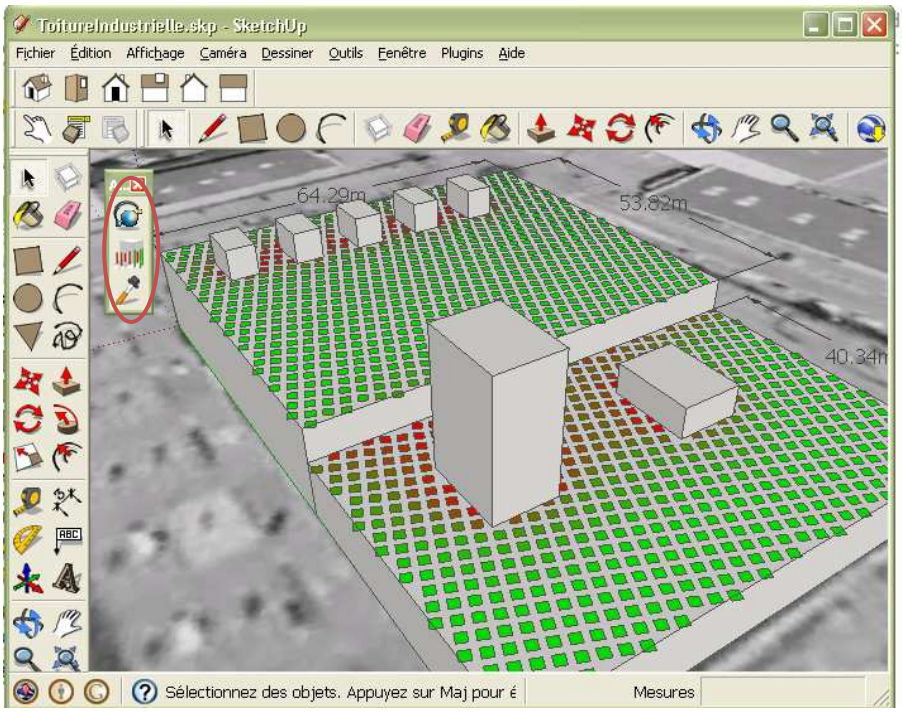


The 3D view manipulation commands are:

		
Translation = Left button + mouse drag	Rotation = Center button + mouse drag	Zoom = Right button + mouse drag

3.3 Compute solar irradiations from Google SketchUp

With Archelios PRO you can create your Archelios project directly from Google SketchUp. The information contained in the SketchUp file is read and interpreted (position, inclination, module type...) and the project is ready for photovoltaic sizing. Three SketchUp plug-in tools are available:



Archelios/SketchUp plugin toosl

NB: Attention, pour des raisons de temps de calcul le nombre de points de calcul du gisement est limité à 100.

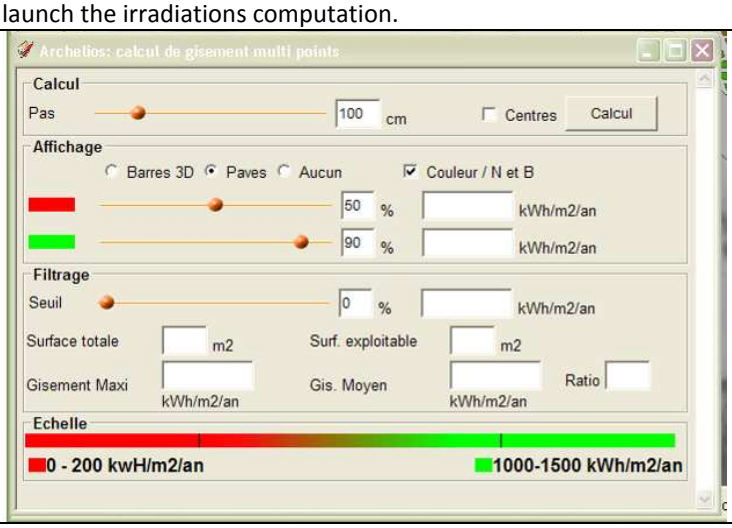
Lorsque le nombre de points demandés dépasse cette valeur, seuls 100 mesures seront effectuées, réparties régulièrement sur les modules (1 module sur N pris encompte) .

A chaque calcul un groupe nommé Archelios est réinitialisé dans votre modèle SktechUp. Pour ne pas perdre l'affichage graphique des calculs précédents vous devez renommer ce groupe avant de relancer les calculs : *sélection du groupe, clic droit, infos sur les entités*.

[9] If the buttons are not visible in Google SketchUp you can manually copy the content of "My Documents\Archelios\Autres\PluginSketchUp" directory in your Google SketchUp installation directory (i.e. C:\Program Files\Google\Google 7\Plugins SketchUp).

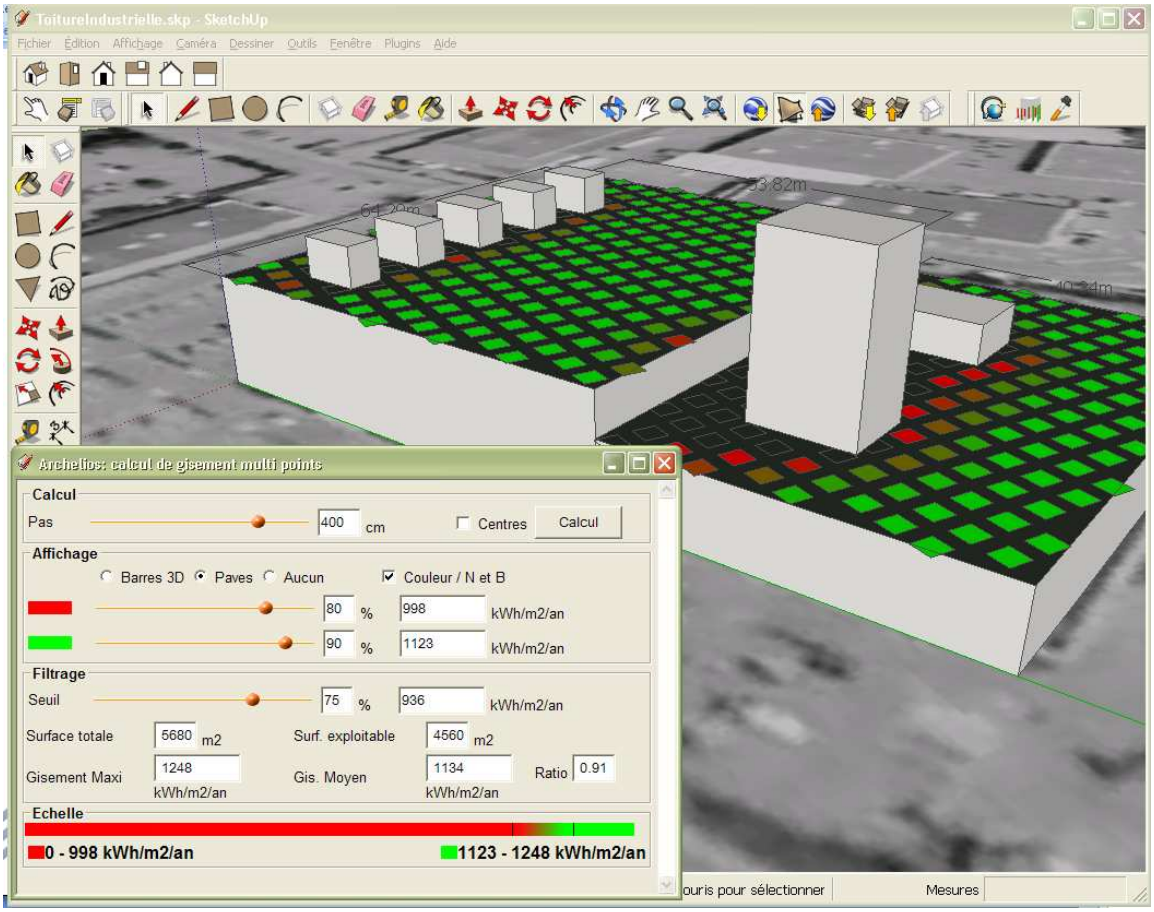
- The command allows you to calculate solar irradiation with and without mask at several locations.

First create your 3D project 3D according to the paragraphs 3.2.4 - 3.2.1. Then click on the button to launch the irradiations computation.

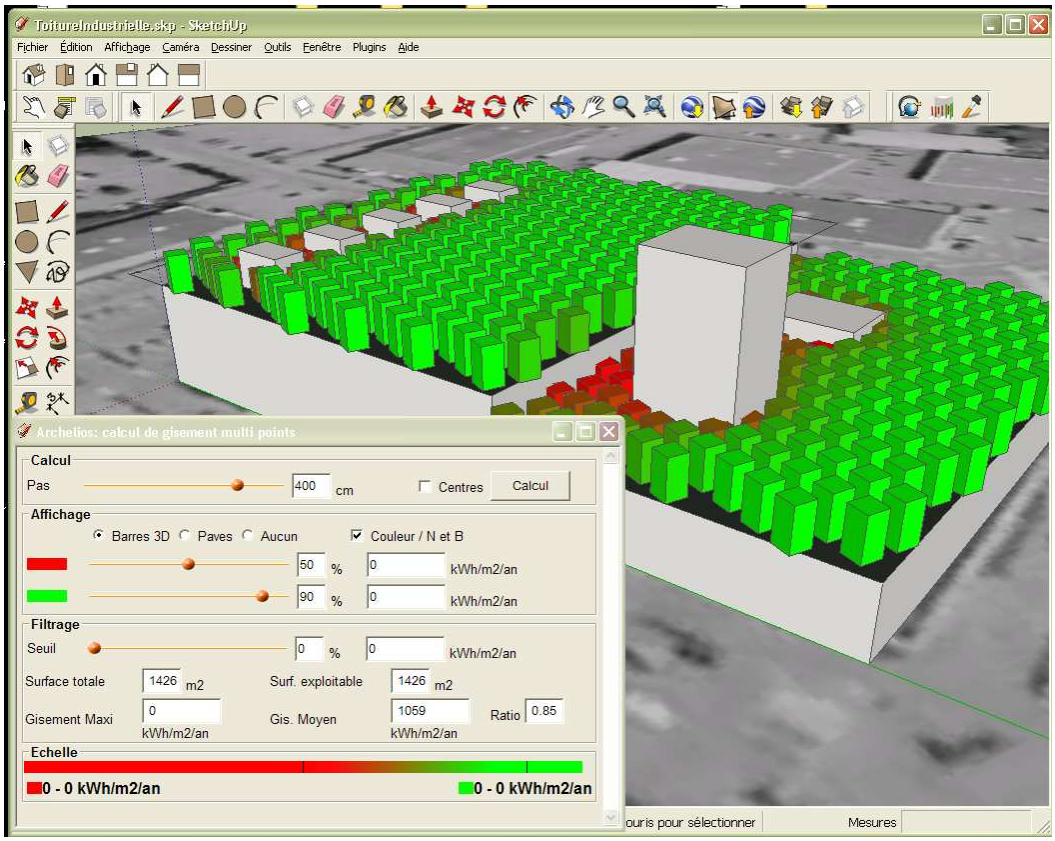


Computation type : regular spacing or face centers
Graphic output : 3D, 2D , B&W or Color
Filter : hide portions where irradiation is lower than a given
Scale

Multipoint irradiation settings

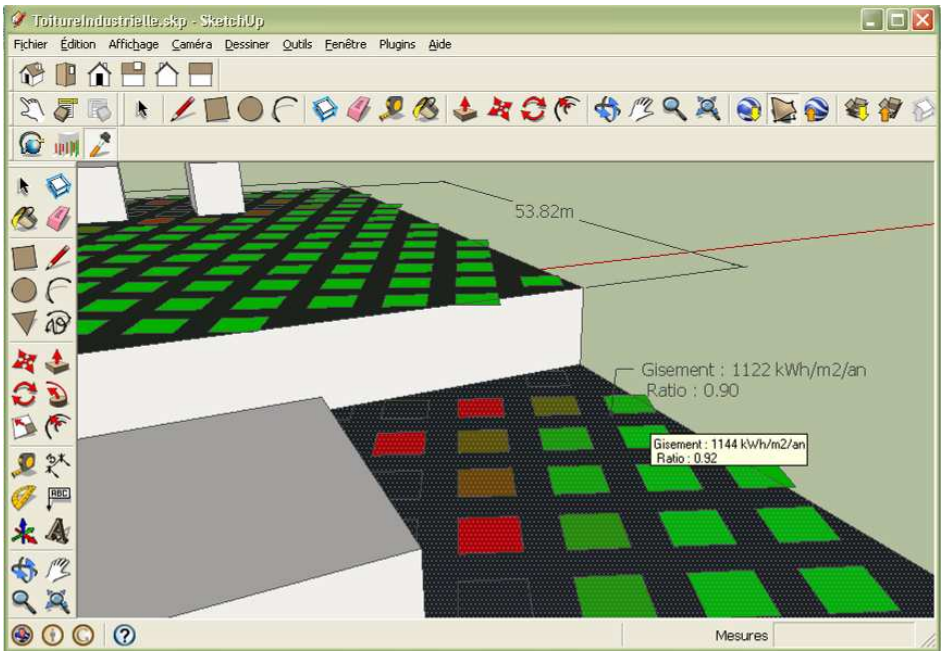


Irradiations computation from Google SketchUp, 2D result, filter at 936 kWh/m2/year


ToitureIndustrielle.skp - SketchUp
Fichier Édition Affichage Caméra Dessiner Outils Fenêtre Plugins Aide
Archelios: calcul de gisement multi points
Calcul
Pas 400 cm Centres Calcul
Affichage
Barres 3D Paves Aucun Couleur / N et B
50 % 0 kWh/m2/an
90 % 0 kWh/m2/an
Filtrage
Seuil 0 % 0 kWh/m2/an
Surface totale 1426 m2 Surf. exploitable 1426 m2
Gisement Maxi 0 kWh/m2/an Gis. Moyen 1059 kWh/m2/an Ratio 0.85
Echelle
0 - 0 kWh/m2/an
0 - 0 kWh/m2/an
ouris pour sélectionner
Mesures

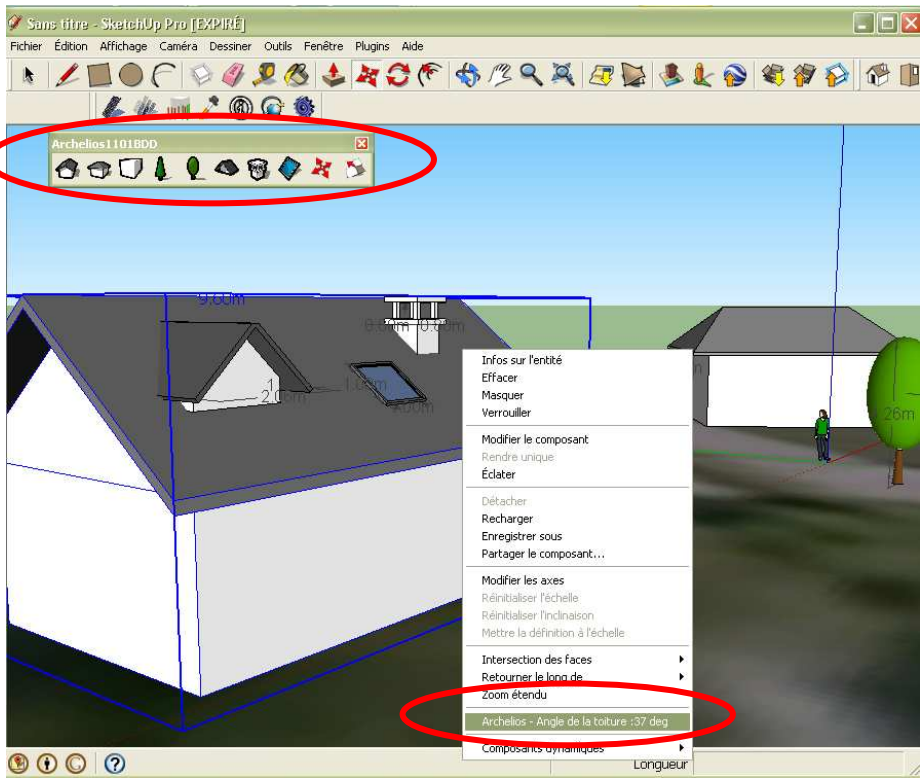
Irradiations computation in Google SketchUp, 3D display

When irradiation computation is done, you can view the values of irradiations with the tool:
Put your mouse over a colored face, the irradiation is displayed.
By clicking with the left button you can create a 3D text displaying the irradiation.



Display of irradiation values

3D objects database: drop buildings, trees in your 3D project



3.4 PRO *Create a project from Google SketchUp*

- The button allows you to create automatically an Archelios project from the SketcUp 3D model.

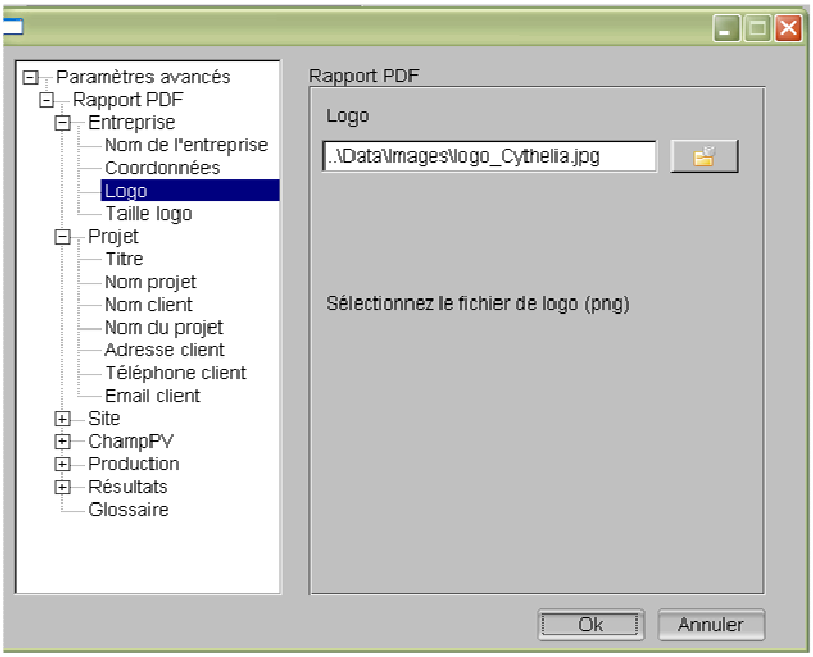
- First create your 3D project 3D according to the paragraphs 3.2.4 - 3.2.1. , then click on the button. Archelios is automatically launched and a PV project is filled in. The following steps are also performed:
    - Automatic closest weather station selection
    - Automatic far mask computation
    - Near mask computation
    - Auto selection of an average module *
    - Auto selection an average inverter *
    - The economic scenario is selected (from the name defined in the advanced settings)

* You can set the default field (type of module + inverter) in advanced settings.

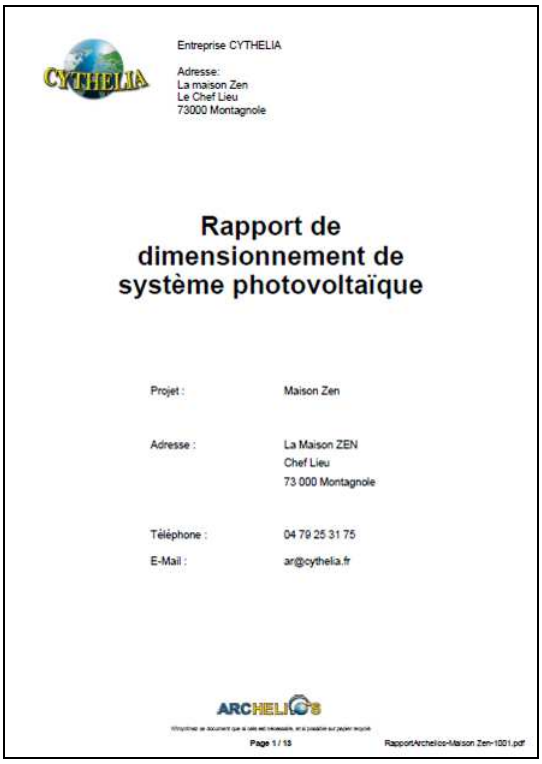
Once Archelios is displayed you can access all of the traditional project settings.

3.5 Paramétrage du rapport PDF

Vous pouvez définir le contenu du rapport PDF et modifier un certain nombre de paramètres comme l'ajout du logo et des coordonnées de votre entreprise, l'affichage de données détaillées de production ou les graphiques annuels.



Paramétrage du rapport PDF



Entreprise CYTHELIA

Adresse:
La maison Zen
Le Chef Lieu
73000 Montagnole

Rapport de dimensionnement de système photovoltaïque

Projet :	Maison Zen
Adresse :	La Maison ZEN Chef Lieu 73 000 Montagnole
Téléphone :	04 79 25 31 75
E-Mail :	ar@cythelia.fr

ARCHELIOS

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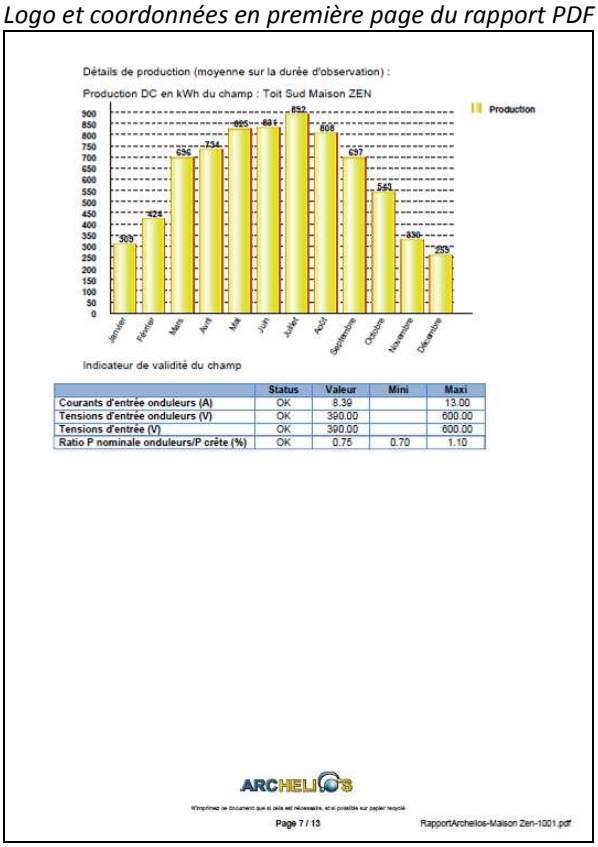
Logo et coordonnées en première page du rapport PDF



Détails de production (moyenne sur la durée d'observation) :

Production DC en kWh du champ : Toit Sud Maison ZEN

Indicateur de validité du champ

	Status	Valeur	Mini	Maxi
Courants d'entrée onduleurs (A)	OK	8.39		13.00
Tensions d'entrée onduleurs (V)	OK	390.00		600.00
Tensions d'entrée (V)	OK	390.00		600.00
Ratio P nominale onduleurs/P crête (%)	OK	0.75	0.70	1.10

ARCHELIOS

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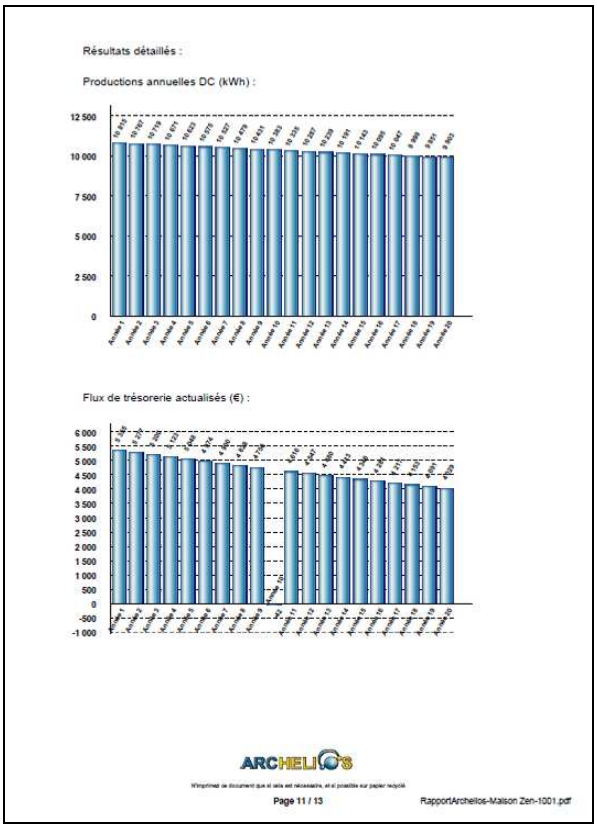
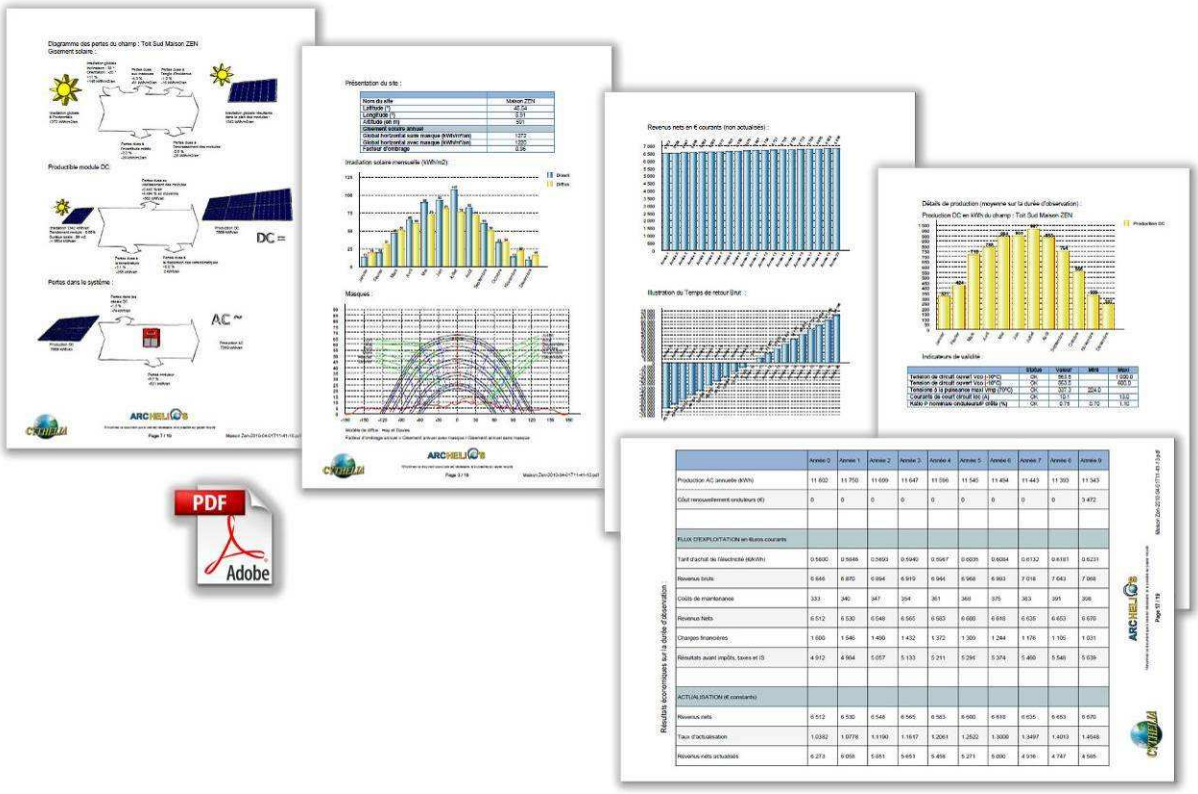
Indicateurs de validité et détails de production champ/champ



Détails de production et revenus année/année



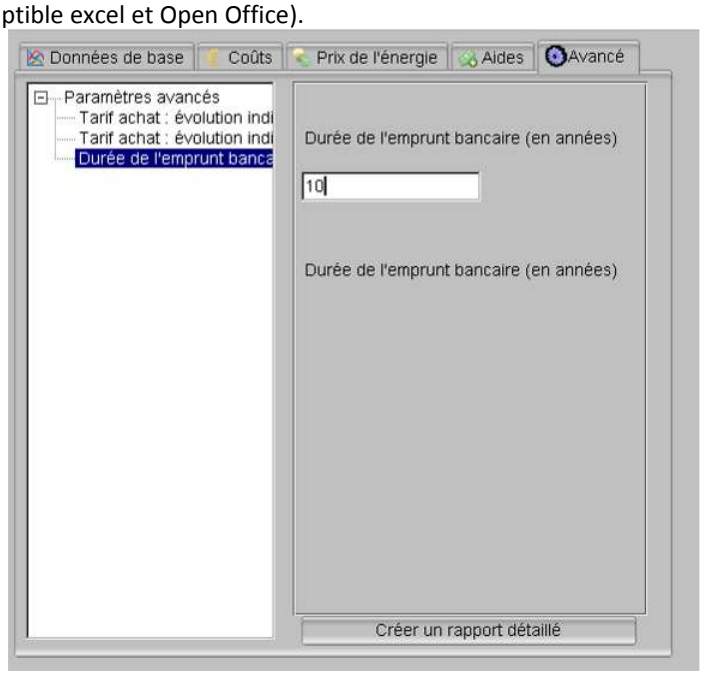
Nouveaux éléments du rapport PDF (version 10.02 à 10.04) :

- Diagrammes des pertes,
- Gisements solaires,
- Revenus bruts et actualisés,
- Indicateurs de validité,

Illustrations et commentaires
Nouveaux coûts « Autres »
Tableau des résultats financiers sur la durée d'observation

3.6 Rapport financier détaillé :

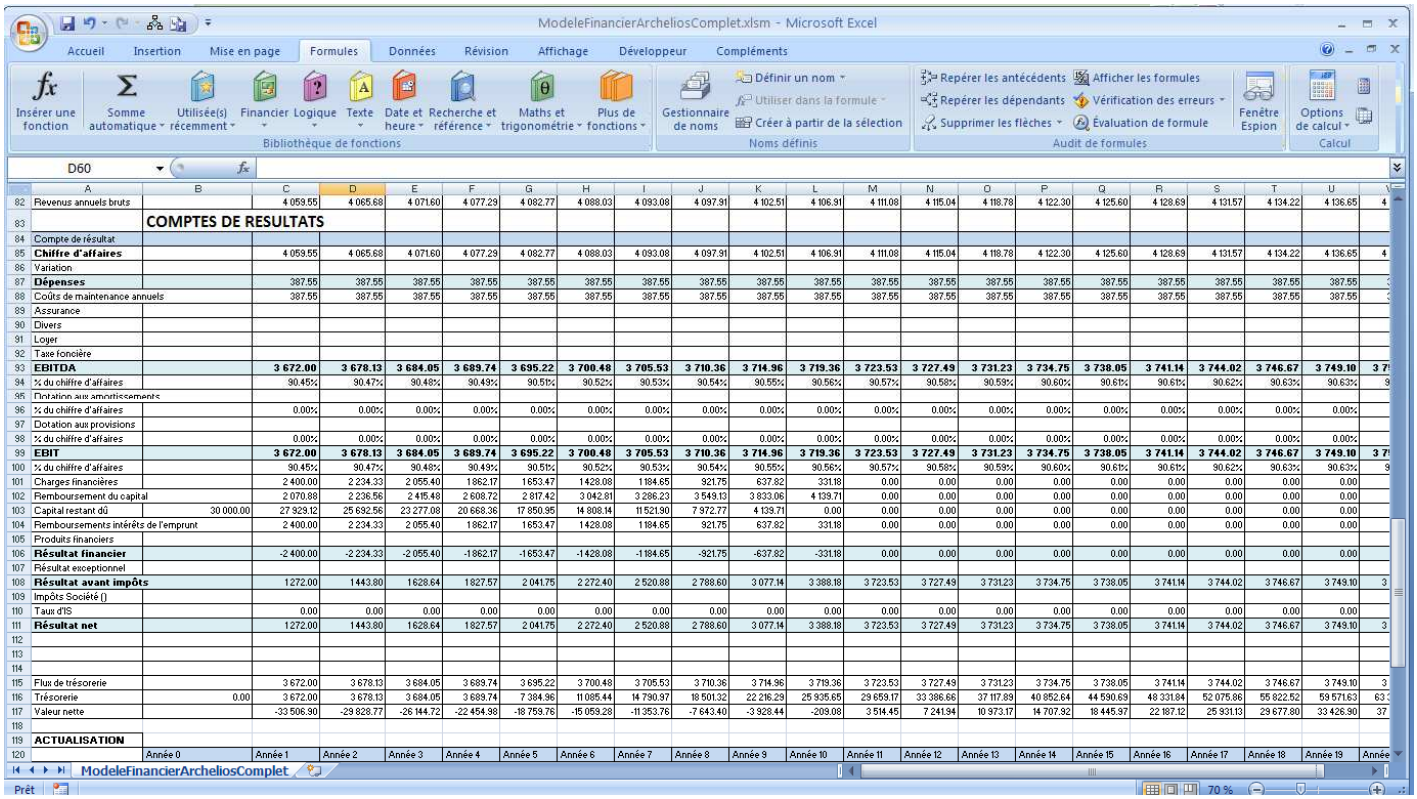
A partir de l'ongle Economie/Avancé vous pouvez paramétrer et éditer un rapport financier détaillé au format tableur (comptible excel et Open Office).



Paramétrage du rapport financier détaillé

Archelios remplit dans le tableur l'ensemble des paramètres ou résultats issus du projet et de la simulation. Les paramètres purement comptables ou financiers (règles de calcul de taxe professionnelle, gestion de la TVA …) sont à remplir par vous.

NB : le fichier généré est au format csv, sans mise en forme (couleur, quadrillage). Pour obtenir une mise en page conforme à l'illustration ci-dessus vous pouvez copier les valeur depuis le fichier généré et les coller dans le fichier mis en forme qui se trouve à l'emplacement siuvant : «*MesDocuments / Archelios / Economics1001 /ModeleFinancierArcheliosComplet.xlsx ».*



ModeleFinancierArcheliosComplet.xlsm - Microsoft Excel

82	Revenus annuels bruts		4 059.55	4 065.68	4 071.60	4 077.29	4 082.77	4 088.03	4 093.08	4 097.91	4 102.51	4 106.91	4 111.08	4 115.04	4 118.78	4 122.30	4 125.60	4 128.69	4 131.57	4 134.22	4 136.65	4
83	**COMPTES DE RESULTATS**																					
84	Compte de résultat																					
85	**Chiffre d'affaires**		4 059.55	4 065.68	4 071.60	4 077.29	4 082.77	4 088.03	4 093.08	4 097.91	4 102.51	4 106.91	4 111.08	4 115.04	4 118.78	4 122.30	4 125.60	4 128.69	4 131.57	4 134.22	4 136.65	4
86	Variation																					
87	**Dépenses**		387.55	387.55	387.55	387.55	387.55	387.55	387.55	387.55	387.55	387.55	387.55	387.55	387.55	387.55	387.55	387.55	387.55	387.55	387.55	
88	Coûts de maintenance annuels		387.55	387.55	387.55	387.55	387.55	387.55	387.55	387.55	387.55	387.55	387.55	387.55	387.55	387.55	387.55	387.55	387.55	387.55	387.55	
89	Assurance																					
90	Divers																					
91	Loyer																					
92	Taxe foncière																					
93	**EBITDA**		**3 672.00**	**3 678.13**	**3 684.05**	**3 689.74**	**3 695.22**	**3 700.48**	**3 705.53**	**3 710.36**	**3 714.96**	**3 719.36**	**3 723.53**	**3 727.49**	**3 731.23**	**3 734.75**	**3 738.05**	**3 741.14**	**3 744.02**	**3 746.67**	**3 749.10**	**3 7**
94	% du chiffre d'affaires		90.45%	90.47%	90.48%	90.49%	90.51%	90.52%	90.53%	90.54%	90.55%	90.56%	90.57%	90.58%	90.59%	90.60%	90.61%	90.61%	90.62%	90.63%	90.63%	9
95	Dotation aux amortissements																					
96	% du chiffre d'affaires		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
97	Dotation aux provisions																					
98	% du chiffre d'affaires		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
99	**EBIT**		**3 672.00**	**3 678.13**	**3 684.05**	**3 689.74**	**3 695.22**	**3 700.48**	**3 705.53**	**3 710.36**	**3 714.96**	**3 719.36**	**3 723.53**	**3 727.49**	**3 731.23**	**3 734.75**	**3 738.05**	**3 741.14**	**3 744.02**	**3 746.67**	**3 749.10**	**3 7**
100	% du chiffre d'affaires		90.45%	90.47%	90.48%	90.49%	90.51%	90.52%	90.53%	90.54%	90.55%	90.56%	90.57%	90.58%	90.59%	90.60%	90.61%	90.61%	90.62%	90.63%	90.63%	9
101	Charges financières		2 400.00	2 234.33	2 055.40	1 862.17	1 653.47	1 428.08	1 184.65	921.75	637.82	331.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
102	Remboursement du capital		2 070.88	2 236.56	2 415.48	2 608.72	2 817.42	3 042.81	3 286.23	3 549.13	3 833.06	4 139.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
103	Capital restant dû	30 000.00	27 929.12	25 692.56	23 277.08	20 668.36	17 850.95	14 808.14	11 521.90	7 972.77	4 139.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
104	Remboursements intérêts de l'emprunt		2 400.00	2 234.33	2 055.40	1 862.17	1 653.47	1 428.08	1 184.65	921.75	637.82	331.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
105	Produits financiers																					
106	**Résultat financier**		-2 400.00	-2 234.33	-2 055.40	-1 862.17	-1 653.47	-1 428.08	-1 184.65	-921.75	-637.82	-331.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
107	Résultat exceptionnel																					
108	**Résultat avant impôts**		1 272.00	1 443.80	1 628.64	1 827.57	2 041.75	2 272.40	2 520.88	2 788.60	3 077.14	3 388.18	3 723.53	3 727.49	3 731.23	3 734.75	3 738.05	3 741.14	3 744.02	3 746.67	3 749.10	3
109	Impôts Société ()																					
110	Taux d'IS		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
111	**Résultat net**		1 272.00	1 443.80	1 628.64	1 827.57	2 041.75	2 272.40	2 520.88	2 788.60	3 077.14	3 388.18	3 723.53	3 727.49	3 731.23	3 734.75	3 738.05	3 741.14	3 744.02	3 746.67	3 749.10	3
112																						
113																						
114																						
115	Flux de trésorerie		3 672.00	3 678.13	3 684.05	3 689.74	3 695.22	3 700.48	3 705.53	3 710.36	3 714.96	3 719.36	3 723.53	3 727.49	3 731.23	3 734.75	3 738.05	3 741.14	3 744.02	3 746.67	3 749.10	3
116	Trésorerie	0.00	3 672.00	3 678.13	3 684.05	3 689.74	7 384.96	11 085.44	14 790.97	18 501.32	22 216.29	25 935.65	29 659.17	33 386.66	37 117.89	40 852.64	44 590.69	48 331.84	52 075.86	55 822.52	59 571.63	63
117	Valeur nette		-33 506.90	-29 828.77	-26 144.72	-22 454.98	-18 759.76	-15 059.28	-11 353.76	-7 643.40	-3 928.44	-209.08	3 514.45	7 241.94	10 973.17	14 707.92	18 445.97	22 187.12	25 931.13	29 677.80	33 426.90	37
118																						
119	**ACTUALISATION**																					
120		Année 0	Année 1	Année 2	Année 3	Année 4	Année 5	Année 6	Année 7	Année 8	Année 9	Année 10	Année 11	Année 12	Année 13	Année 14	Année 15	Année 16	Année 17	Année 18	Année 19	Année

Rapport financier détaillé

4. Glossary :

Peak Power:
Power (in Wp) provided by modules in watts in standard test conditions ((1 000 W/m², AM 1.5 spectrum, 25°C cell temperature)

Yield:
Energy produced by the photovoltaic installation, in kWh

AC:
Alternative Current

DC:
Direct Current

Specific Yield:
yield normalized to installed power, in kWh/kWp

Performance Ratio:
ratio beetween specific yield and annual incident irradiation

Return on investment time:
ratio beetween investemnt and annual cash-flow

Discount rate:
rate representing the cost of access to the capital

Net Present Value:
Generated Value at the end of Observation period

Actual return on investement time:
Observation time nullifying the net present value

Internal Rate of Return:
discout rate nullifying the net present value

Profitability Index:
ratio beetween net present present value and investment

BOS, Balance Of System:
Cost including all components of a photovoltaic system, except modules